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NOVEMBER 27, 1959

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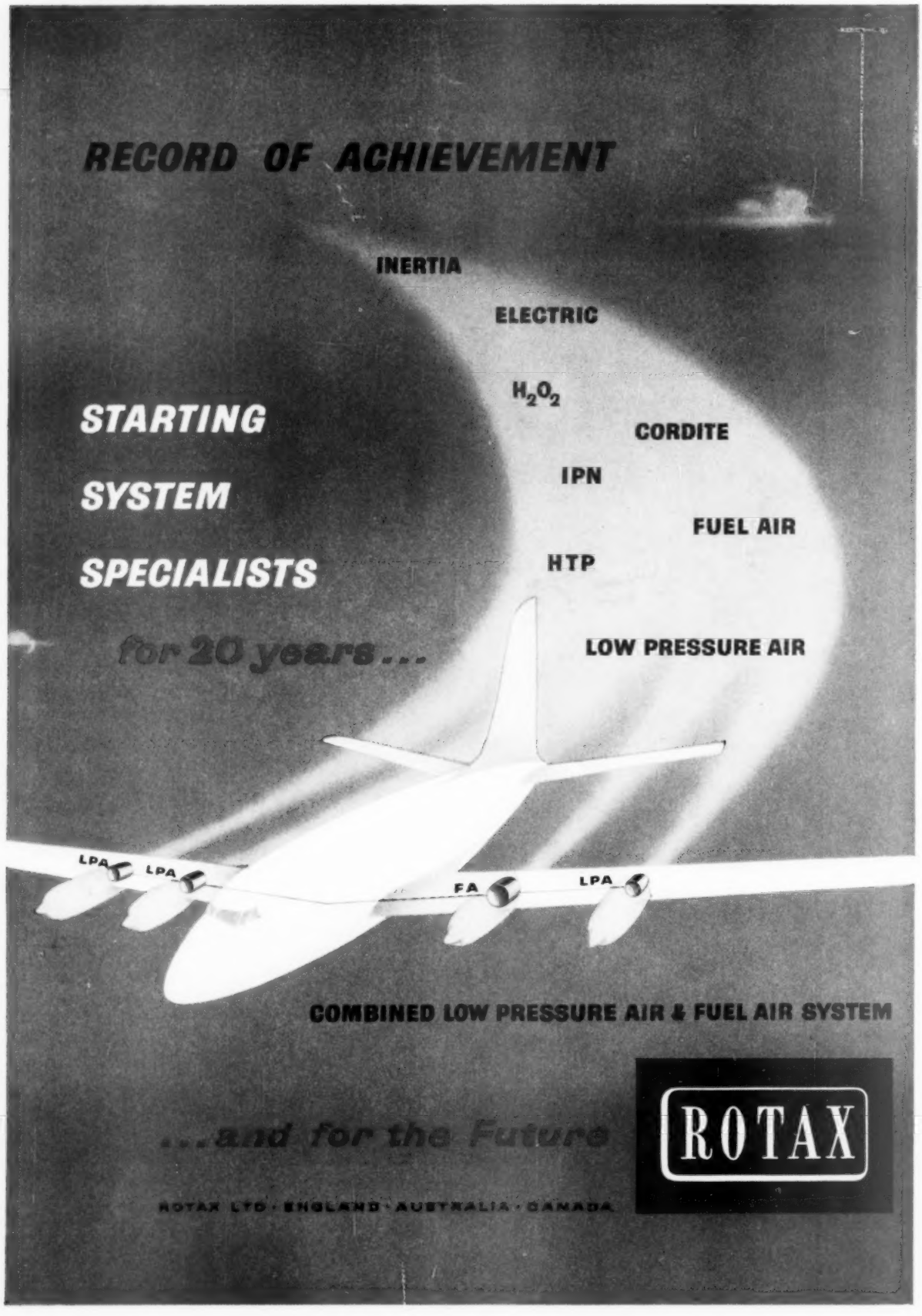

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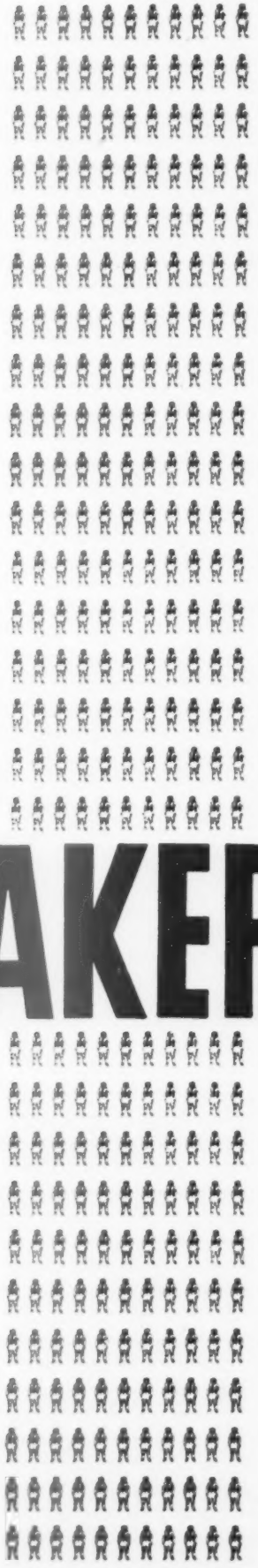

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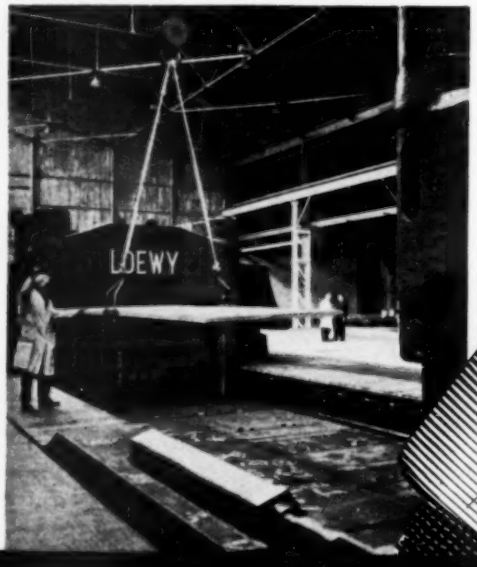

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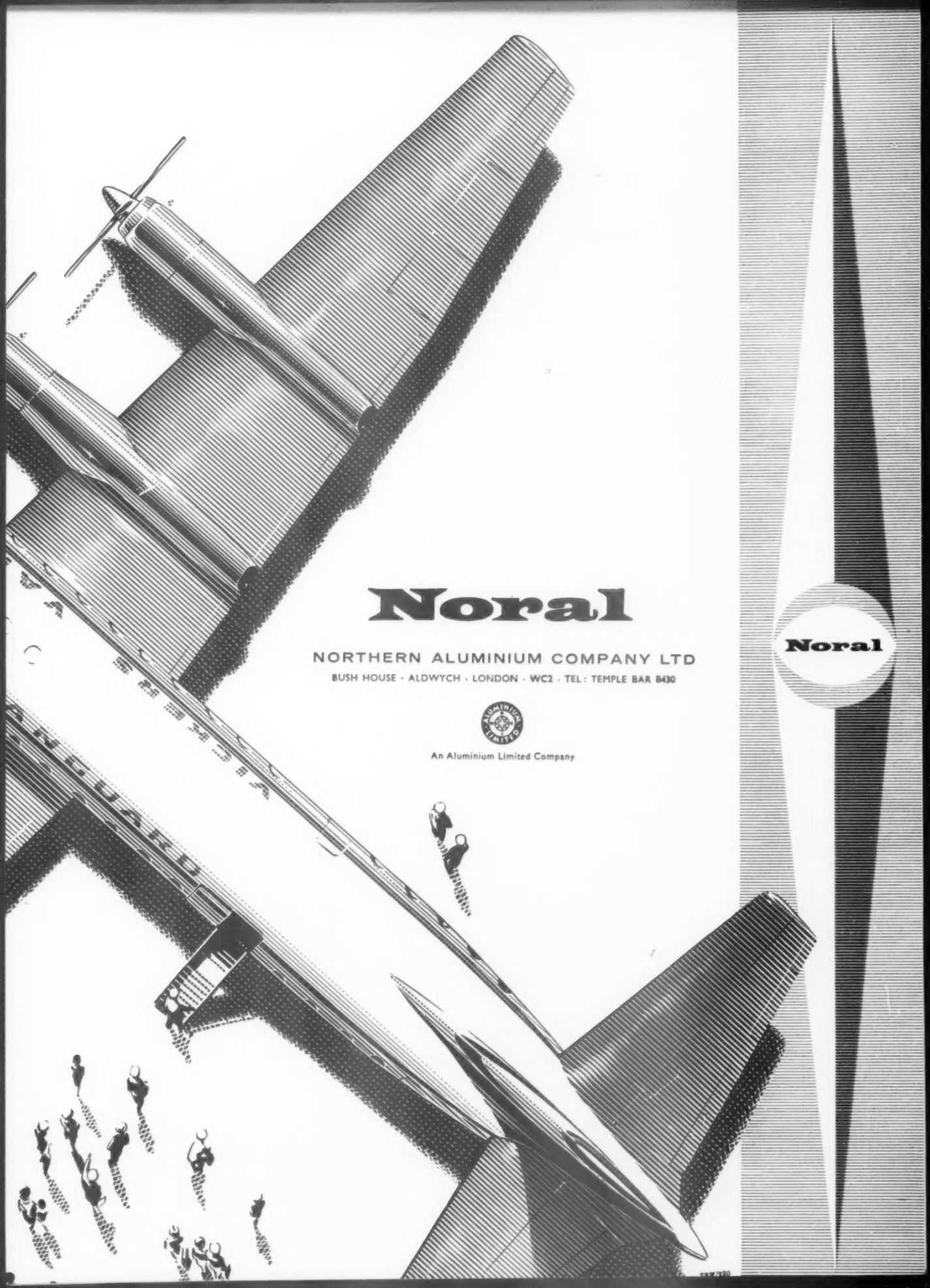
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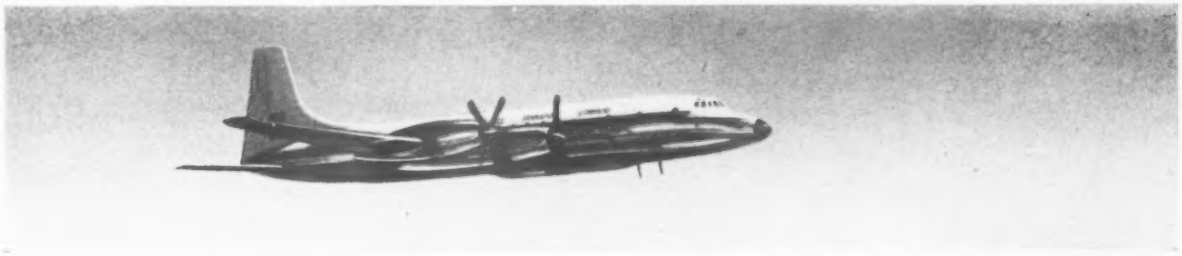

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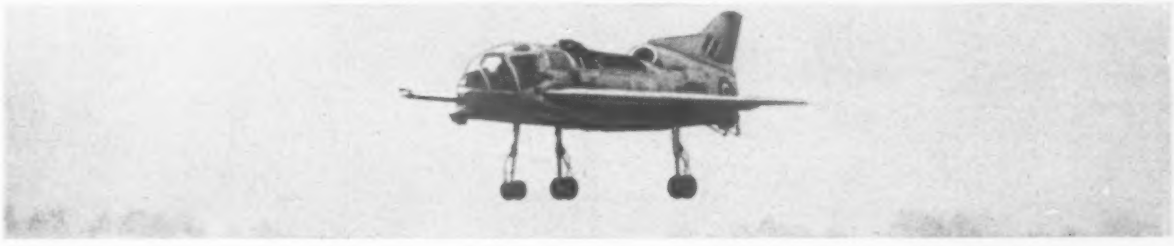

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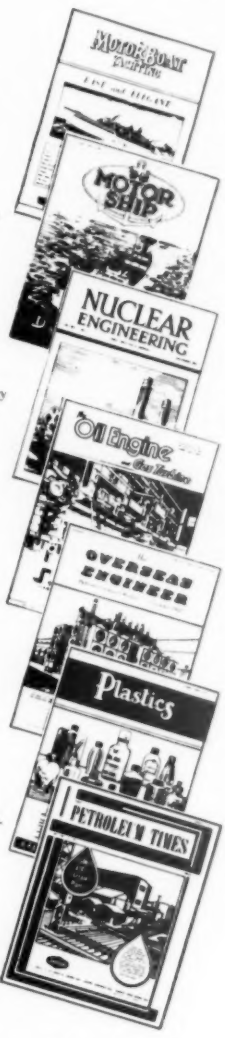

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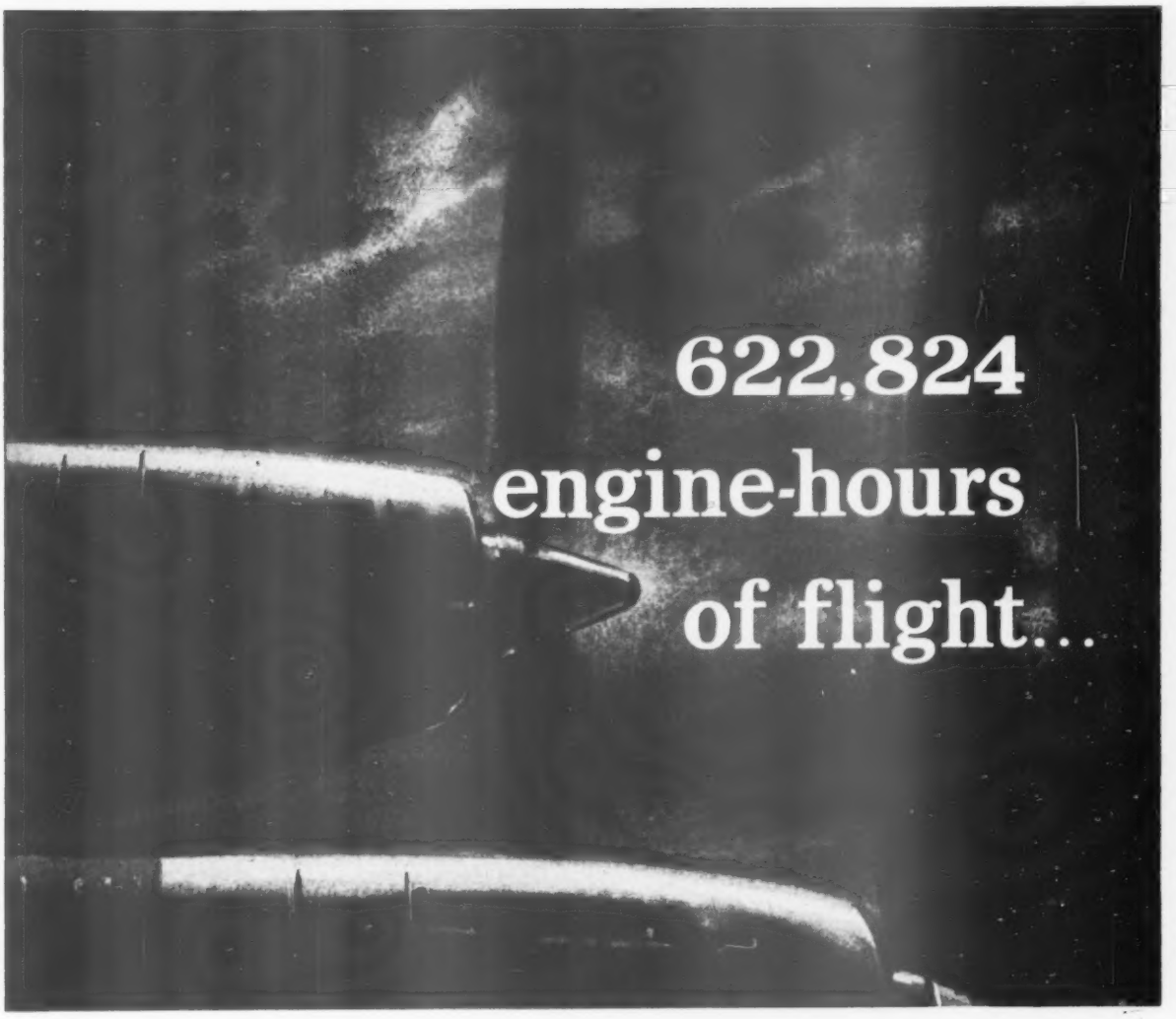

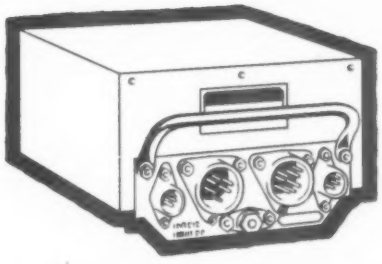

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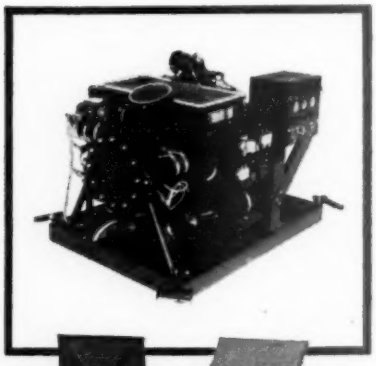

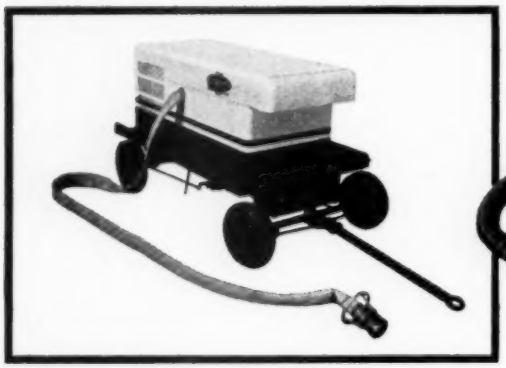

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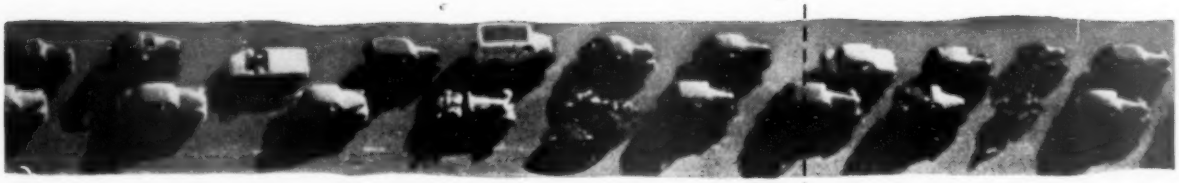

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THE AEROPLANE and ASTRONAUTICS

VOLUME 97 NUMBER 2510 NOVEMBER 27, 1959

A Royal Lead to Executives

What a splendid example has been set by His Royal Highness the Prince Philip in taking a Heron of the Queen's Flight to Ghana. Here is a demonstration for all to see of the potentialities of the so-called executive class of aircraft, that is the class of aircraft of sufficient performance to carry men of affairs reliably about their business to the four corners of the Earth.

To do this such aircraft must have high cruising speed, they must have built-in reliability in the form of a multiplicity of powerplants and they must have installed the most up-to-date communications equipment and navaids. We in Great Britain are not doing enough in this field. Prince Philip's flight should be regarded not only as a demonstration of what can be done with British aircraft but also as a spur to do more. This is an example of how important trips for important people can be done by comparatively simple aeroplanes.

Disseminating Information

We have always understood the primary function of a scientific body to be the dissemination of knowledge peculiar to the activities of its members. This it does by the holding of meetings, the giving of lectures and the printing of scientific papers. And, like all circulations, the circulation of knowledge is most beneficial when it is most unfettered. It is for this reason we have always deplored any tendency to hold, under the cloak of security, meetings organized by scientific bodies. Such limitation of audience and the consequent restriction on discussion must have a sterilizing effect.

It was therefore with mixed feelings that we read last month of the new policy of the Royal Aeronautical Society with regard to lectures. Hitherto lecturers have been recommended by the R.Ae.S. lectures committee, but since October members of the Society, and non-members, have been invited to submit papers for presentation as lectures. This is obviously a good thing. No shrinking violet need feel that he or she is born to blush unseen; any worthwhile ideas or report of an investigation now have a good chance of being aired. However, and this is the nub of the matter, the decision has been taken only to guarantee the publication of the Commonwealth, the Blériot, Lanchester and Wilbur Wright memorial lectures and the inaugural memorial lectures given before branches. Furthermore, advance copies of main lectures will no longer be printed.

Now, always assuming that the R.Ae.S. lectures committee has selected worthwhile lecturers, and who is there to say that this distinguished body has not, this decision can only mean a slowing down in the means of technological communication. Yet this is the very function that is the primary function of a scientific body.

This decision has, no doubt, been taken against the background of increased printing costs which applies to all forms of publishing. The publications of the R.Ae.S. also look to advertising to reduce the cost to the Society of disseminating information, thus reduction in the activities of the Industry must be expected to reduce such support.

It is unlikely, with the pressure on editorial space experienced these days by the editors of all technical journals, that many of these original contributions passed over by the R.Ae.S. for publication will find their way into print—which is where the best means of communication lie. We wonder, therefore, whether the Society, covering as it now does, the whole realm of motion off the ground, will not have to look to its publishing policy—perhaps even re-examining the format of the *Journal* itself.

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Matters of Moment

Royal Flight—Executive Style

PRINCE PHILIP'S evident dislike—shared by most pilots—of flying as a passenger, however comfortably, was illustrated by his recent flight to Ghana in a D.H. Heron of the Queen's Flight. His Royal Highness uses the Heron extensively as an executive aircraft for journeys throughout the U.K. and Europe, but this is the first time that he has taken it so far afield, instead of travelling by B.O.A.C.

On the present trip, Prince Philip is sharing the flying with Sqn. Ldr. K. J. Hannah, a Queen's Flight pilot, and another R.A.F. officer, Flt. Lt. Baker, is acting as navigator. Another Heron of the Queen's Flight is accompanying the Royal aircraft on its 3,500-mile journey.

This began at Hatfield in the early hours of Sunday, November 22, with a night take-off by Sqn. Ldr. Hannah in misty conditions of about 300-yd. visibility. The Duke had been received by Mr. John Cunningham, chief test pilot of de Havilland Aircraft, after driving himself from Luton Hoo. The first leg of the air trip was scheduled to Bordeaux, but the Royal aircraft was diverted through fog to Cognac, some 117 miles away.

After this refuelling stop, the Heron made another at San Juan military airfield, Majorca, before flying on to El Golea, a remote desert airfield in Algeria. A night stop was spent at this base, which has been used for operations by the French Air Force against rebel forces.

On the following day, stops were scheduled to be made at Tessalit, also in Algeria, and Niamey, in French West Africa, before arrival in Accra in the late afternoon. The Duke is due to leave Ghana on November 29, and arrive back in the U.K. on the following day.

SACLANT ARRIVAL.—Air Marshal Sir Edward Chilton, A.O.C.-in-C., Coastal Command, being greeted by Admiral J. Wright, U.S.N., Supreme Allied Commander, Atlantic, on his arrival at SACLANT Headquarters, Norfolk, Virginia, for a conference of major SACLANT subordinate commanders. Air Marshal Sir Edward Chilton is also Air C.-in-C. Eastern Atlantic Area.

The Electronics Industry and Space

A DISTINGUISHED audience in London on November 18 heard the chairman of the Radio Industry Council ask that the Government should not overlook that industry in formulating its space projects. Mr. E. E. Rosen, who was speaking at the annual dinner of the Radio and Electronics Industry, said:—

"The Industry should be taken more into the confidence of Her Majesty's Government on the country's space project programme. Electronics are such a vital part of any space project that I cannot conceive that the best results can be obtained by being dealt with in isolation."

Mr. Rosen then asked the rhetorical question whether the Industry was not the guider of guided weapons. All machines and missiles travelling in outer space would have to rely on equipment produced by their Industry.

With reference to this part of Mr. Rosen's speech it is to be noted that the emphasis at past Radio Dinners has tended to be on broadcast entertainment, but the Industry was born in Britain 25 years before broadcasting was thought of and the members of it are rightly proud of the many remarkable things it has done both before and since. Today as Mr. Rosen's words show, its leaders are thinking of what it has to do and can do.

They realise that the age of space travel is upon us and this is very largely an electronics problem. This country possesses electronics knowledge and experience second to none in the World. Much of it is in the hands of big manufacturers, all of whom are members of the Electronic Engineering Association. This has technical committees, it has the collaboration of the Valve, Semi-conductors and Component Makers Associations, it can arrange liaison as requisite with the Telecommunications, the Scientific Instrument, the Business Machine and other such manufacturing Associations. Moreover, it has now organized a very successful Electronics Forum.

The guest of honour at the Dinner was Lord Adrian, Master of Trinity College and Vice-chancellor of Cambridge University, who referred among many other things in his speech to the work of Dr. de Bruyne on aeronautical adhesives.

Sir Arthur fforde, chairman of the board of governors of the B.B.C., replied to Lord Brabazon who had proposed the health of the guests.

NEW KAMAN.—Being produced for the U.S.N. at the rate of one a month, the new Kaman HU2K all-weather helicopter follows current fashion in having its T58 powerplant mounted atop the fuselage. It is also noteworthy as the first Kaman helicopter to have a single-main rotor/tail rotor layout.

Howard Levy photographs

FREIGHTER AIRBORNE.—Canadair's prototype Tyne-engined CL-44D made its first flight on November 15 at Montreal; it is the first of 12 ordered by the R.C.A.F. Canadair has 26 orders and options for the swing-tail civil version of the CL-44D; a cut-away drawing and description of this last-named appears on pages 537 to 541.

Significant Decision

FUTURE prospects of Scottish Aviation, Ltd., have been the subject of recent Parliamentary questions; the point at issue is whether the Army Air Corps will adopt the de Havilland Beaver, the Scottish Aviation Pegasus or some other type as a light liaison aircraft. Pressure is being brought to bear on the Government for the adoption of the Pegasus.

This aircraft is apparently only at the design study stage, and is, in effect, a lighter development of the Pioneer. It will carry six or seven passengers and a pilot. Although for the Army it is artificially restricted to a 4,000-lb. all-up weight, it is likely to carry a one-ton payload at a higher weight.

According to newspaper reports the decision between the Beaver and Pegasus was considered at a meeting of the Defence Committee on November 21. This followed a meeting on November 11 between the Prime Minister and a delegation representing Scottish Aviation and other Scottish interests.

The order in dispute is said to be for about 30 light liaison aircraft costing about £750,000 and it is reported that the Beaver is favoured by the Army, doubtless as a well-tried aircraft which can be bought off the shelf. Although this is a relatively small order in itself, it is important as marking the first of its kind since Mr. Duncan Sandys took over his new Ministry of Aviation. The decision will thus be a pointer to the future as to whether small companies will continue to receive "rescue" orders or will be allowed to go out of aircraft manufacture. It may also indicate whether the placing of orders will still depend on local unemployment, as has happened in the past.

Mr. Sandys has expressed his keenness for large groupings of companies. His decision in this case will be watched closely by many companies larger than Scottish Aviation.

Fairey Affairs

ALTHOUGH, last week, some disturbing comments concerning the future of the Rotodyne—and some blunt words regarding Ministerial responsibility for its delay—were made by Mr. G. W. Hall, F.R.Ae.S., M.S.A.E., chairman of the Fairey Group of companies, by the time of going to press there had been no official statement giving reassurance as to the position of this important British aircraft. Mr. Hall was presenting his annual report to the shareholders and he went so far as to say that in all the prevailing circumstances his company found it "difficult in the extreme" to decide whether it should persist with a project so large and complicated as the Rotodyne, without a clear and sufficiently large Government order.

Since early in 1958, he said, the company had been encouraged to continue with development, which had been extremely expensive in spite of the greatest care being taken to limit expenditure. "From time to time, both in the House of Commons and elsewhere," he went on, "Ministers of the Crown have made clear their interest and have promised—subject to financial and technical negotiations—that Government assistance would be given both in the form of a contribution to the development costs and by the placing of orders.

"It is because of the period over which these negotiations have stretched—and are still being stretched—that I feel we, as a company, have some considerable complaint. Settlement—and orders—have always been just round the corner, and at no time have we as a board felt that we could afford to stop spending large sums on our efforts to prove the technical feasibility of the aircraft while attempting to reach finality in the contractual sense.

"At this moment we are within a few weeks of the signature of a development contract which would ensure the Government supporting us to the extent of some £4 million. Again, as we stand today, there would appear to be every probability of our receiving an order for military Rotodynes plus the requirement for an initial six from B.E.A., for which we have received a Letter of Intent. I must inform you, however, that this is not yet a firm order and that negotiations with B.E.A. are still proceeding.

"But—and it is a considerable but—time has run away and in consequence the period in which we may expect to sell Rotodynes to operators all over the World has shortened. We have attempted to minimize this delay by incorporating in the production version greater carrying capacity and improved economics.

"We feel that much of the delay I have just referred to arose from the fact that no one Minister was responsible for the research and development needed for civil aviation and the co-ordination of military and civil needs. We hope that the setting up of the Ministry of Aviation will lead to great improvements in this field."

Earlier in his report, Mr. Hall had stated that there had been a very considerable drop in Fairey profits—from £2,231,146 to £509,911—for the year under review compared with the previous year. This was a direct result of the fall-off in aircraft work following the 1957 Defence White Paper.

There had been the need to spend considerable sums on research and development. This heavy expenditure stemmed from two main causes, both of which resulted directly or indirectly from Government policy. This first cause was that now the aircraft industry must finance, on civil projects, the necessary research and development expenditure—either in full or with limited contribution from Government funds. The second cause had been the need, in view of the waning aircraft business, to establish new projects outside the aircraft field.

GAPAN MASTER.—Dr. K. G. Bergin, director of B.O.A.C.'s personnel and medical services, who has been elected Master of the Guild of Air Pilots and Air Navigators for 1959-60.

Matters of Moment . . . .

A New Simulator for B.E.A.

AS a very appropriate postscript to the handing over of B.E.A.'s first two Comet 4Bs on November 16, came the formal acceptance—the following day—by Lord Douglas of Kirtleside, G.C.B., M.C., D.F.C., of a Comet 4B flight simulator. This has, like other simulators used by the Corporation, been produced by the Air Trainers Link division of General Precision Systems, Ltd. It is installed in the B.E.A. Simulator Building at Heston where, too, are the Viscount 700 and 800 simulators and, until recently, the one for the Elizabethan.

Sir John Baker, G.B.E., K.C.B., M.C., D.F.C., chairman of General Precision Systems said, in handing over the installation, that the company was very proud in having completed the simulator ahead of the arrival in service of the first aircraft; the equipment had been designed, manufactured, delivered and installed within 20 months. The company was also proud of the fact that official certification of the simulator had been obtained in 24 hours and it was fully approved and accepted for the whole range of service it was required to give.

Lord Douglas, in reply, spoke warmly of the co-operation received from Air Trainers Link. As the Corporation was buying only seven Comets, he said, there had been much deliberation as to whether the expense of such a simulator would be justified. Their conclusion had been, however, that even with such a small fleet, it would certainly be worth while.

During the next seven months all the 95 pilots selected for B.E.A. Comets would complete their conversion training. The actual amount of flying to be done in the aircraft during this training programme would be only about 7 hr. per pilot. The simulator, he added, had been officially approved by the Ministry of Aviation for use in instrument rating renewals and bi-annual checks.

This new simulator is the first ordered by B.E.A. to be equipped with motion. The flight deck—which is an exact replica of that on the Comet 4B—can be made to pitch ±10° and roll 3° either way, in response to control movements. This is accomplished by an electronically controlled hydraulic jack system the principal unit of which is a Comet nosewheel jack. As the flight deck portion of the simulator weighs in the region of 3½ tons the problems involved in providing the required motion without any built-in unevenness or shudder, were by no means negligible.

Conversion courses for the B.E.A. Comet pilots are, we understand, planned to take 18 hr. altogether using the simulator for about 11 hr. of this time and actual aircraft for the remainder. This represents a saving in flying time of about 50%. But this is only part of the overall saving; revenue-earning aircraft need not be withdrawn from operation for training purposes and a large part of the training programme is made independent of weather conditions and inevitable delays. All these factors indicate the order of the economies effected that justify the installation of specialized equipment costing somewhere around £250,000.

Weather and Personal Flying

ONCE again, the silly season is upon us. Every year, at about this time, private pilots begin scattering their light aircraft with monotonous regularity over golf courses, playing fields and other open spaces through running out of daylight or visibility during our short Northern winter days.

Everyone who flies in Britain sooner or later gets caught by the weather. In its latest newsletter, the Surrey and Kent Flying Club bemoans the fact that regularly, over the past few Sunday afternoons, some of its members flying from Biggin Hill, have found themselves force-landed in fields. And last week-end also saw a Hawk Trainer from Elstree down on a convenient golf course.

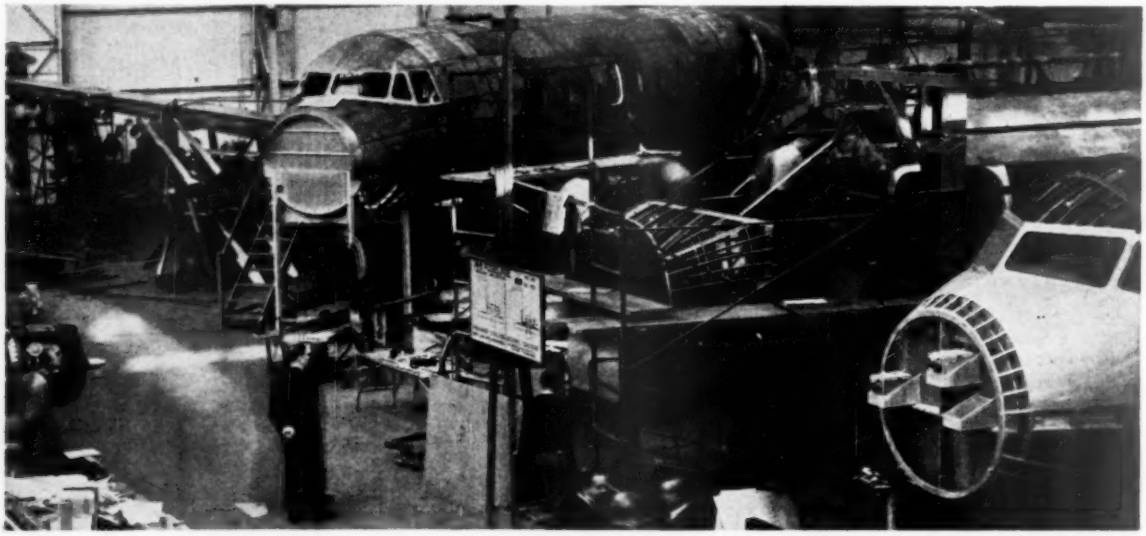
These achievements pale alongside those of that other private pilot, who last Friday caused the complete suspension of London Airport's flying activities for 23 minutes, at untold expense, complication and not a little hazard, simply by arriving unannounced in its circuit at dusk. This is guaranteed to make the authorities take a really sympathetic viewpoint of personal flying problems.

According to newspaper and radio reports, the pilot of the Messenger in question entered cloud on a flight from Staverton to Eastleigh, and emerged completely lost. He apparently sent out an emergency call on his radio, and this was picked up by R.A.F. Bovingdon. Reporting that he was over a green flashing beacon resulted in Bovingdon pinpointing his position as London Airport, which was accordingly alerted. London Radar is apparently unable to pick out aircraft immediately overhead, and the Airport therefore suspended all operations.

The Messenger was, according to published reports, without navigation, cockpit or instrument lighting, temporary illumination being provided by a pocket lighter. When this failed, compass readings were taken by flashes of the flint. By then, Gatwick made contact and took over the job of homing the Messenger, which eventually landed there.

It was fortunate that the aircraft was equipped with radio, but this incident stresses the need for more navigational aids and fixing services for the private pilot, apart from any requirements for improved flying discipline. In the clubs, it seems that the latter must be achieved by stricter standards of instruction.

ELAND-CONVAIRS.—Last week we briefly recorded the order that has been placed with Napiers for 15 Eland turboprop powerplants for Allegheny Airlines' five Convair 540 conversions. In next week's issue of THE AEROPLANE AND ASTRONAUTICS we propose to include details of the equipment and information about the airline.



PROGRESS AT CHADDERTON.—Work on the Avro 748 prototype proceeds apace at Manchester and the starboard wing is now in position as this recent photograph shows. The second fuselage is in the jig; the nose of the mock-up is right foreground.

Astronautics and Missile News

WOOMERA RECORD.—A satellite tracking camera at W.R.E., Woomera, has secured the only photographs so far obtained of the U.S. satellite, Discoverer VII. The Australian Minister of Supply, Mr. Hulme, said that two separate photographs were taken on November 11.

SPACE CO-OPERATION? — According to Dr. Keith Glennan, NASA administrator, U.S. and Russian scientists have started informal talks with a view to a co-operative programme of space exploration. The talks have been between NASA scientists and a four-man Russian delegation which has been attending an American Rocket Society meeting in Washington.

OPERATIONAL ATLAS.—The Atlas ICBM squadron at Vandenberg AFB, California, has been integrated into Strategic Air Command's war plan and is now ready to launch at 15 minutes' notice, according to Maj.-Gen. David Wade, commander of the U.S.A.F.'s first missile division.

DISCOVERER VIII.—The U.S. Air Force has again failed in an attempt to recover a 300-lb. capsule from a Discoverer satellite. Launched from Vandenberg on November 21, Discoverer VIII entered an "eccentric orbit" which caused the capsule to be ejected on the 15th orbit instead of the 17th, as originally planned.

VENUS PROBE?—Reports from America suggest that NASA will attempt to launch a Venus probe on, or about, December 10 using a five-stage version of Thor-Able. The probe will be equipped with solar batteries for operating electrical equipment.

RADAR OUTPOST?—According to reports, a large radar facility is to be built "somewhere in Britain" to provide early warning of ICBM attack. It will apparently be powerful enough to detect launchings at a distance of 3,000 miles, and the Americans are believed to have allocated several hundred million dollars to the project.

This huge radome is being assembled at the missile and surface radar plant of the Radio Corporation of America at Moorestown, N.J. It was fabricated and is being erected for R.C.A. by the Goodyear Aircraft Corp., of Akron.

General Aviation News

KREMLIN 'COPTER.—An Mi-4 helicopter was demonstrated to Russian leaders, including Mr. Khruschev, in the grounds of the Kremlin on November 11. During his American visit, Mr. Khruschev admired Mr. Eisenhower's personal S-58, and tentative negotiations have started with Sikorsky to purchase three similar helicopters.

LOST OVER LONDON.—A privately owned Miles Messenger caused London Airport to close for 23 minutes on Friday, November 20, when it appeared in the circuit at dusk. Its pilot, Mr. Robert Bell, had taken off from Staverton for Portsmouth, but lost his way en route. He discovered the London Airport beacon and was subsequently homed for a safe landing to Gatwick.

VERTOL TAKEOVER.—Negotiations are in being between the Boeing Airplane Co. and the Vertol Aircraft Corp. with a view to the latter company being acquired by Boeing. If this plan goes through the Vertol team at Morton, Pa. would become the Vertol Division of Boeing.

LINNET CHANGE.—A change in the organization of Garland-Bianchi Aircraft at Maidenhead is reported by Douglas Bianchi, who has severed his connection with the company. He is continuing with the activities of Personal Plane Services at White Waltham, and is increasing his efforts to import light aircraft—especially the Rousseau Emeraude—from Europe. The Emeraude is being produced by Garland-Bianchi Aircraft as the Linnet.

ANOTHER RUSSIAN RECORD.—Latest World Record to be claimed by Soviet aviation (see last week's issue) is that for speed over 100 km. by helicopter. The massive Mi-6 is claimed to have achieved 167.206 m.p.h., compared with the 141.8 m.p.h. previously established by a Sikorsky H-34 of the U.S. Army.

BOEING SPARES.—A European pool store for Boeing 707 spares is to be set up at Orly by Boeing Airplane Co. in the spring of 1960.

LANCHESTER LECTURE. — The Third Lanchester Memorial Lecture was due to be given last night by Prof. Dr. H. Schlichting; his subject was "Some Developments in Boundary Layer Research in the last Thirty Years." Prof. Schlichting, an eminent German specialist in this subject, has worked in this field since the late 1920s and spent five years with Dr. Prandtl studying boundary-layer theory.

LONG DROP.—A new height record for a parachute descent was recently established by Capt. Joseph Kittinger of the U.S.A.F., who jumped from a balloon flying at 76,400 ft. over New Mexico. The 300-ft. helium-filled plastic balloon took 90 min. to reach its peak altitude, where the temperature in its open gondola was 104° below zero. Capt. Kittinger made a free fall through some 66,000 ft. before his parachute was automatically deployed.

SOLARTRON DELIVERY. — A second Solartron radar simulation system for Italy—this time for the Italian Air Force—left Bovingdon on November 11 in four Fairchild Packets. Another of these simulators is on demonstration tour in Europe.

SIKORSKY ORDER.—A $23 million order for "S-58-type" helicopters for the U.S. Navy has been placed with Sikorsky. The order covers anti-submarine and troop and cargo transport versions.

RAMJET COLLABORATION.—The existence can now be revealed of a technical collaboration agreement between the Royal Swedish Air Board and Bristol Siddeley Engines, Ltd., which covers the development of ramjet engines. Signed in 1957, this agreement has hitherto been on the secret list.

C-130 ORDER.—The Republic of Indonesia has ordered five C-130B Hercules turboprop transports from Lockheed's Georgia Division. The contract includes an option to buy five more Hercules.

HEAVY AIRDROP.—A 20,000-lb. bulldozer leaving a U.S.A.F. Hercules during Exercise Ranger Bulldozer, the largest American peacetime equipment airdrop. The load was lowered by six 100-ft. canopies; 30 mins. later, it was being used to construct an airstrip.

Commercial Aviation Affairs

T.W.A. JET SERVICE. — T.W.A. inaugurated their jet service across the North Atlantic on November 23 eastbound, and November 24, westbound, between New York and London and Frankfurt. T.W.A. offers non-stop service in each direction "regardless of weather," using Intercontinental Boeing 707-331s. Initial frequency is three flights a week, increasing to one a day in January, 1960, and two a day in the summer peak.

JET RE-ORDERS. — Ansett-A.N.A. has ordered a third Lockheed Electra. American Airlines will buy one more Boeing 707-120, to be used for certification of the turbofan-engined version. T.C.A. is reported to be ordering four more Conway-engined DC-8s.

OPEN - RATE OPPORTUNITY. — South African Airways has announced plans for an economy-class fare of £219 return between Johannesburg and London next summer in its Boeing 707s. Present I.A.T.A.-standard tourist fare is £273. The route is one on which the I.A.T.A. Traffic Conferences have failed to agree and an "open-rate" situation will exist after April 1.

A LONG CHARTER. — Overseas Aviation (C.I.), Ltd., recently completed a 33,000-mile charter flight with one of its five Argonauts. Fixed by Lambert Brothers, this flight carried the Czech Philharmonic Orchestra from Prague to Australasia, for concert appearances in Auckland, Christchurch, Melbourne, Sydney and Brisbane; and then on to Tokyo. From Tokyo, a ship's crew was flown back to the U.K. In 39 days, the Argonaut was behind schedule only once.

ONE HUNDRED UP.—Deliveries of the Lockheed Electra passed the 100 mark with the recent arrival of two Qantas L-188Cs in Australia. They will be used on the route from Sydney to Tokyo via Darwin, Manila and Hong Kong.

BRITANNIA OVERHAULS.—Bristol Aircraft will do 3,600-hr. overhauls on C.P.A.'s eight Britannias under a newly signed contract. The company is already responsible for the 1,800-hr. overhauls of these aircraft.

DERBY TO DUBLIN.—Derby Aviation has received M.o.A. approval for a scheduled service from Luton and Derby to Dublin. The licence is for seven years and permits up to seven flights a week with Dakotas or 14 a week with Marathons.

COMET PROSPECTS.—Misrair, the Egyptian airline, is reported to be about to purchase three Comet 4s. Misrair has been a prospective Comet purchaser for some time, and the contract is only subject to the completion of satisfactory financial arrangements. Another likely buyer is the French U.A.T., which may soon order four Comet 4Cs.

S.A.S. SELL DC-6s.—Aeronaves de Mexico has purchased six of the original S.A.S. fleet of 12 Douglas DC-6s, plus spares and crew training facilities. Three of the DC-6s have already been sold to Guest Aerovias and the other three will be used by Transair, of Sweden.

News About People

HONOURED.—At an investiture at Buckingham Palace on November 17, Mr. E. C. Wheeldon, managing director of Westland Aircraft, Ltd., was appointed C.B.E.—the announcement of which was made in the Birthday Honours list.

A.B.A.C. NEWS.—The Rt. Hon. Alan Lennox-Boyd, M.P., has accepted office as a vice-president of the Association of British Aero Clubs and Centres. Mr. Lennox-Boyd has been keenly interested in the flying club movement for many years, and in 1953, when he was Minister of Transport and Civil Aviation, he presented the Association with a trophy to be awarded each year to the most efficient club.

MASTER PILOTS.—GAPAN has awarded master pilot certificates to the following: Capt. L. Arthur, D.F.C., captain (Senior 1st Class). B.O.A.C. Comet Flight; Capt. K. C. Deadman, instructor, B.O.A.C. Comet Flight; Capt. F. Fischer, D.F.C., chief check and training captain, T.A.A.; Capt. C. C. Forman, check and training captain, T.A.A. DC-4 flight; Capt. N. Rodnight, Hunting-Clan Air Transport.

LONDON RECEPTION.—Sheikh Najib Alamuddin, chairman of Middle East Airlines (right), with Mr. R. M. Hilary of Napiers at a reception given by the Sheikh in London.

VISITOR TO C.F.E.—Viscount Caldecote, chairman and managing director of English Electric Aviation Ltd., accompanied by Air Cdre. Strang-Graham recently visited the Central Fighter Establishment at West Raynham. Here (l. to r.) are Wg. Cdr. Lord, station commander; Gp. Capt. Crowley-Milling, Acting Commandant; Lord Caldecote; Air Cdre. Strang-Graham; and Air Vice-Marshal Hartley, A.O.C. No. 12 Group.

GLOSTER APPOINTMENTS.—Mr. F. J. Turton, who has been service manager at the Gloster Aircraft Co. for the past 14 years, has been appointed manager of Gloster's factory and airfield at Moreton Valence, near Gloucester. Mr. A. Serle, who has been assistant service manager since 1952, succeeds Mr. Turton as service manager.

BACK HOME.—Mr. Jack Rasmussen has returned to this country from the Caribbean, where he looked after Vickers - Armstrongs (Aircraft), Ltd., after-sales service, and is now attached to the sales department at Weybridge.

Air Transport

B.E.A. Introduces Jet Service

WITHIN three months of putting the de Havilland Comet 4B into regular service, B.E.A. expects to achieve average daily utilization of about seven hours per aircraft, and an annual utilization rate of 2,400 hours. This figure is only slightly less than the utilization of Viscounts 6½ years after they went into service with B.E.A., and is a very high target for a short-haul operation.

That it has been planned at all is a tribute to the Comet's reliability and an indication of B.E.A.'s eagerness to get into the jet business. The Comet is not only the Corporation's first jet transport but is also the first major new equipment B.E.A. has introduced since the Viscount went into service. Nearly 20% of B.E.A. capacity ton-miles will be produced by the seven Comets next summer.

Passengers will be carried in B.E.A. Comets for the first time within the next week or two, although the full-scale introduction of the new aircraft is not scheduled to begin until next April. As training commitments permit, and to provide pilots under training with route experience, Comets will replace Viscounts between now and April on an *ad hoc* basis on some routes such as those to Nice, Zürich, Frankfurt and Dusseldorf.

The table below shows the routes, journey times and frequencies of Comet services to be introduced between April and July next year. These are not all separate services; for instance, Rome and Munich are both transit points on the services to Athens, from which some services continue to Istanbul and some to Nicosia and Tel Aviv. Similarly, Oslo and Stockholm will be worked on a single service. For the most part, the Comet services will be out-and-back in a day; exceptions are the flights to Warsaw, where the aircraft and crew will night-stop, the Moscow service, leaving London at midnight, a night service to Malta and night flights to Stockholm and Zürich.

Introduction	Route	Journey Time		Weekly Frequency
		hr.	min.	
April 1	London—Munich	1	35	2
	London—Rome	2	10	7
	London—Warsaw	2	30	2
	London—Moscow	3	30	2
	London—Athens	4	40	9
	London—Istanbul	6	30	5
	London—Nicosia	6	55	2
	London—Tel Aviv	7	25	4
May 1	London—Dusseldorf	1	05	7
	London—Copenhagen	1	40	9
	London—Nice	1	45	14
	London—Oslo	1	55	7
	London—Malta	2	45	1
	London—Stockholm	3	30	7
May 14	London—Zurich	1	25	2
July 1	London—Zurich	1	25	14
	London—Frankfurt	1	15	7

The B.E.A. Comet services to the Eastern Mediterranean will be closely integrated with Olympic Airways' services which, with two Comet 4Bs, will fan out from Athens and serve additional cities not on the B.E.A. network. The Olympic Comets are scheduled for delivery early next year, and will be maintained by B.E.A., which is also training Olympic crews.

Three-pilot Operation

B.E.A. has chosen, after very careful consideration, to crew its Comets with three pilots; crews of the Vanguard and probably the D.H.121 will be similarly constituted, although the actual division of duties between the three pilots may differ from type to type.

The Comet crews comprise a captain and two first officers. All will be trained on the systems panel (containing fuel, pressurization and de-icing controls), although the captain will not normally "fly" the panel in service. The first officers will be proficient in the right hand seat and at the panel, and will serve alternately at the two positions for specified periods.

B.E.A. believes that this arrangement gives improved safety by providing a closely integrated team, each member of which is fully conversant with the others' jobs, to the extent of being able to take over in an emergency. An additional factor was that the Corporation at present employs no flight engineers and that pilots were available for the job.

A start was made this month on training the 30 three-pilot crews which B.E.A. requires for its Comets by next July. All are ex-Viscount captains and first officers, being replaced in turn by Dakota crews moving up; and all, in due course, will be expected to graduate on to D.H.121s. The normal conversion course comprises five weeks of ground instruction; two weeks of base conversion, involving some 40 hours on the newly installed Air Trainers-Link simulator; about eight hours' base flying; two or three route simulation flights, and 10-12 sectors on line training.

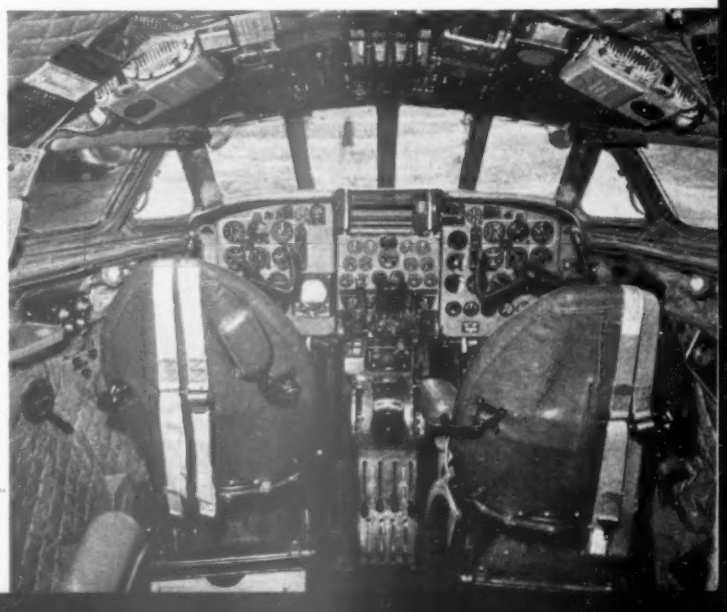
This training programme is being handled by Capt. Atkins with six other captains in collaboration with Capt. G. Greenhalgh, the Comet flight manager. As the Comet is B.E.A.'s first jet, special attention has been paid to giving these training captains an adequate background of experience. Last December they took ground courses at Hatfield and Derby, and early this year flew the Comet 3B for a few hours each. They then spent some time studying the R.A.F.'s Comet operations at Lyneham and flew as supernumerary crew with No. 216 Squadron on the route to the Far East. B.O.A.C. operations were also studied and flights were made on Comet 4 training flights. Finally, the Comet flight manager, assistant training flight manager, and senior base flying and line training captains obtained some valuable experience on the Comet 4B during its test flying.

The first Comet 4B was handed over to B.E.A. seven weeks ahead of schedule, on November 9 (with a second on November 16), and in the first eight days, 56 hours' flying was achieved. The next task is to give the training captains the necessary 50 hours before they can start work; this has to include 20 hours on the routes, with 10 hours in command, for which an intensive six-day programme of route flying began on November 21.

Flying training is based at Stansted, where a self-contained unit has been set up for ground engineers as well as for pilots; if weather is bad at Stansted, arrangements have been made for flying to continue at Prestwick, Bedford, Lyneham, or even in North Africa.

B.E.A.'s Comets are laid out for 86 passengers, including 22 in four-abreast seating in the first-class lounge. The aircraft have the new white, black, red and silver external finish, and the cabin colours are predominantly charcoal and coral. Individual aircraft names, which are of astronomers, are carried only inside the cabin and are as follows for the first six aircraft: G-APMA, "Edmond Halley"; G-APMB, "Walter Gale"; G-APMC, "Andrew Crommelin"; G-APMD, "William Denning"; G-APME, "John Tebbutt"; and G-APMF, "William Finlay."

Total capital commitment by B.E.A. on the seven Comets to date, including associated spares, is just over £9 million. When the plan to buy Comets was first announced by B.E.A. it was stated that the fleet would be depreciated over five years and then sold back to de Havilland.



The Comet 4B flight deck has been re-designed for B.E.A.'s three-pilot operation. The systems panel is to starboard behind the co-pilot, with a further position to port for a radio operator when required.

Photograph copyright "The Aeroplane and Astronautics"

Air Transport . . . .

707 Accidents and Incidents

THE recently published Civil Aeronautics Board report on the 707's dive over the North Atlantic on February 3, 1959, has cleared up some of the less well understood aspects of this affair and provided detailed information about the sequence of events. More information has also become available about the training accidents on Long Island on August 15 and near Seattle on October 19.

The basic cause of the near-disaster in February to a Pan American 707 on a scheduled westbound North Atlantic service was given by the C.A.B. as co-pilot inattention after disengagement (for unknown reasons) of the autopilot. The aircraft, with 110 passengers and 10 crew, was flying at 35,000 ft. in smooth air with the co-pilot in charge. When the autopilot disengaged, the 707 entered, "smoothly and slowly," a steep descending spiral, and the co-pilot was unaware of this fact until he felt buffeting and acceleration forces. His own instrument panel lights had gone out, but he saw that the captain's artificial horizon had "toppled" and, from the movement of the stars, that the aircraft was in a nose-down right-hand spiral and nearly on its back. He unsuccessfully attempted recovery, but was immobilized by *g* forces.

When the captain had struggled back into his seat he reduced power to idle and saw that the altimeter was passing through 17,000 ft., that the turn indicator was showing maximum right deflection and that the stabilizer was full nose down. His electric trimmer failed to function. He rolled the aircraft level while in cloud and, with *g* forces relieved, the flight engineer could turn the manual stabilizer wheels. A steady pull on the control yoke initiated final recovery at about 6,000 ft.

Boeing-interpreted information from the flight recorder carried in the American Airlines' 707, which was lost in the training accident on Long Island, suggests that the aircraft developed a severe yaw to the right about 14 seconds before impact: a roll to the right followed and the aircraft became inverted. Recovery was completed and a pull-out initiated just before impact. The 707 was making an approach to land (probably with engines 3 and 4 throttled back) and was at 1,000 ft. and flying at 145 knots when an (apparently intentional) pitch-down manœuvre was initiated. This was followed by the yaw and roll, with the aircraft inverted eight seconds afterwards.

The Braniff Airways training accident apparently developed from a demonstration of recovery from a Dutch roll. In an extreme attitude an incorrect recovery action appears to have inverted the aircraft. Two engines were "thrown" in this manœuvre and a third was lost when taking recovery action.

B.O.A.C. and its DC-7s

THOSE who have read B.O.A.C.'s *Report and Accounts* for 1958-59 will not have been surprised by last Monday's news of the losses likely to be experienced in the re-sale of the 10 DC-7Cs which were purchased for about £13 million in 1955 to tide the Corporation over a difficult period. Two are now being offered for $1 million each (about £357,150) and the remaining eight are due to be sold before next autumn. This somewhat specialist long-haul piston-engined aircraft will inevitably be difficult to sell in the present era, but there might be prospects for it were it to be converted to an all-freight rôle.

The likely re-sale difficulties for the DC-7C were pointed out in THE AEROPLANE of January 2, 1959, (p.2) after the Corporation had been given permission to retain these aircraft beyond the originally agreed period.

Decca Demonstrations

WHATEVER may be the future of international agreement on radio aids, the Decca Navigator System continues to have U.K. support and to be of special interest for operators and controllers in particular areas elsewhere. Last month, for instance, successful demonstrations were made with the company's Valetta in the Rome control area, and last week the advantages of this area-coverage system were shown in the Channel Islands pattern.

A portable two-pattern chain was recently laid down in the Rome area for NATO evaluation purposes with Fiat G-91 strike-reconnaissance aircraft and this was used in the demonstrations on October 14. It provides cover for most of the Rome control area and over a considerable area to the west and north on Airways Amber 1 and Amber 14. A complicated pattern and an abbreviated version were successfully followed in the Valetta and the demonstrations were probably the most comprehensive A.T.C. exercises yet completed with the system.

The Flight Log trace followed with great accuracy the agreed pattern, which included a deviation around Danger Area 42, the joining of Amber 1 Airway and return along it from Elba on a different, parallel track to a point abeam Orbetello. Thence the aircraft was positioned for following a track through a Decca Airway to a holding pattern and a return to Amber 1 and to another holding pattern in the Rome control zone, followed by the intersection of the Ciampino ILS. None of the normal aids was used, though the VOR and NDB facilities were calibrated in the course of the flights.

The level of traffic between the U.K. and the Channel Islands during the summer months is probably greater than in any comparable area in Europe, and the Ministry of Aviation is considering the introducton of a new Airway, Blue 26, between Hastings and Jersey. The demonstrations last week were designed to show how traffic control and sequencing might be improved by the provision of additional flight paths and holding patterns in an area where, because of the restricted land area, there can be few point-source aids. Airway Blue 26 can, in fact, only be flown accurately by the use of an area-coverage system. The South-West British chain was used and the fact that a slave transmitter is located on Jersey itself means that the coverage in the area is very accurate.

Comments from the Corporations

IN a written answer to a Commons question (November 16) the Minister of Aviation presented statements from the two airline Corporations giving their comments on the "Report of the Select Committee on Nationalised Industries" (see our issue of September 4, pp. 88-89).

The most important comment comes from B.E.A., which agrees with the Committee in its conclusion that a merger of the Corporations would be beneficial neither to the individual airlines nor to British air transport as a whole. B.E.A. believes "that the financial savings, if any, would be more than swallowed up by the inherent inefficiency of a very large organization trying to undertake two entirely different tasks." However, the Corporations "are again making a joint survey of possible fields for co-operation. The issues must turn on what is, or is not, more economic; this, in turn, calls for extensive costings which inevitably take time."

B.O.A.C. comments that the problem of aircraft development costs is being examined by the Government departments concerned, that no conclusion has yet been offered, but that, meanwhile, the Corporation has written off, as a capital loss, the £5 million "excess of pre-operational development expenditure." (See our issues of October 30, p. 405; November 6, p. 428, and November 13, p. 461.)

In reply to the Committee's criticisms about engineering costs, B.O.A.C. claims substantial progress in reorganization and points to an improvement in engineering costs from 10½d. per ton/mile in 1957-58, to 9d. in 1958-59, to 7d. so far during the current year, while hoping for a figure of 5½d. per ton/mile for 1960-61. Delays in reorganization are explained by "a difference with the trade unions."

In its general comments B.E.A. points to the inherent problems in the operation of short-haul air transport and to the necessarily narrow margins within which the Corporations must work.

The Air-freight Business

ONCE again the latest (August) freight traffic figures for U.K. aerodromes show a handsome weight increase of 22%, with a figure of 35,598 short tons by comparison with 29,149 tons for August, 1958. These tonnages are not quite representative of actual cargo movements, since they include vehicle-ferry uplifts, but a comparable percentage increase is still shown when the Ferryfield and Southend figures are excluded. The increase in the London area, for instance, excluding Southend, was of the order of 23%—from 4,919 to 6,064 short tons.

Incidentally, Silver City's contribution—Ferryfield's tonnage for this summer month was 18,722—is a reminder of the effect one operator can have on collective traffic results. The BIATA members' figures are consolidated in the Association's annual report (see our issue of November 13, p. 462) and scheduled-service freight, at 113,777 short tons, showed an increase of 31% on the previous year's results. Silver City's share of this was 87,003 tons—or 75.6% of the BIATA members' total.

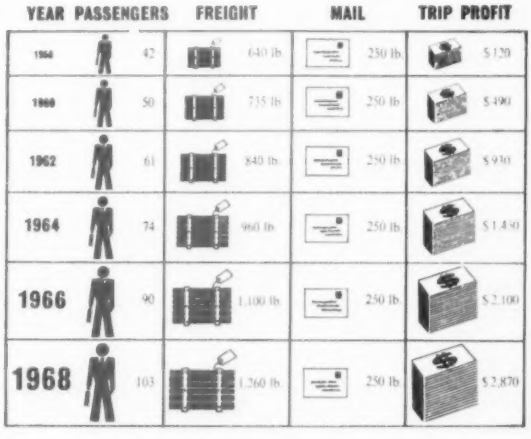
Recently inaugurated all-cargo services include a weekly DC-4 run by Air France between Paris and Fort Lamy (Chad Republic) with traffic stops at Algiers and Reggane; and a three-times-weekly Swissair service with DC-3s between Zürich and Stuttgart.

Only the VANGUARD has this future while making money right from the start

THE VICKERS VANGUARD is designed for growing traffic, yet it will make profits right from its introduction with payloads no bigger than those carried by Viscounts today.

This is clearly shown in the illustration. Profit begins with the first 500-mile trip carrying no more than 42 passengers and 640 lb of freight. Even on modest estimates of traffic and freight increases, its profits will grow considerably with the years.

Assuming a 10% increase per annum in traffic, and 7% in freight, annual and cumulative profit at the end of seven years is remarkably high. By employing the Vanguard's cheap-fare possibilities, payloads and profits could be much higher.



This diagram shows trip profit on a 500-mile sector at realistic European costs and current tourist fares. The start-point is 42 passengers and 640 lb of freight in 1958.

Of all the airliners only the Vanguard has all these features

425 m.p.h. cruising • Freight capacity 7/8 tons at normal densities • Full routeing and A.T.C. flexibility • Can use normal existing airfields • Quick turn-round • No airfield noise problems • Ten years' unique Vickers/Rolls-Royce turbo-prop experience . . . ***And it is 'Viscount' quiet.***

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

• ***The airliner with the biggest profit potential ever offered to the operator***

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

AT 628

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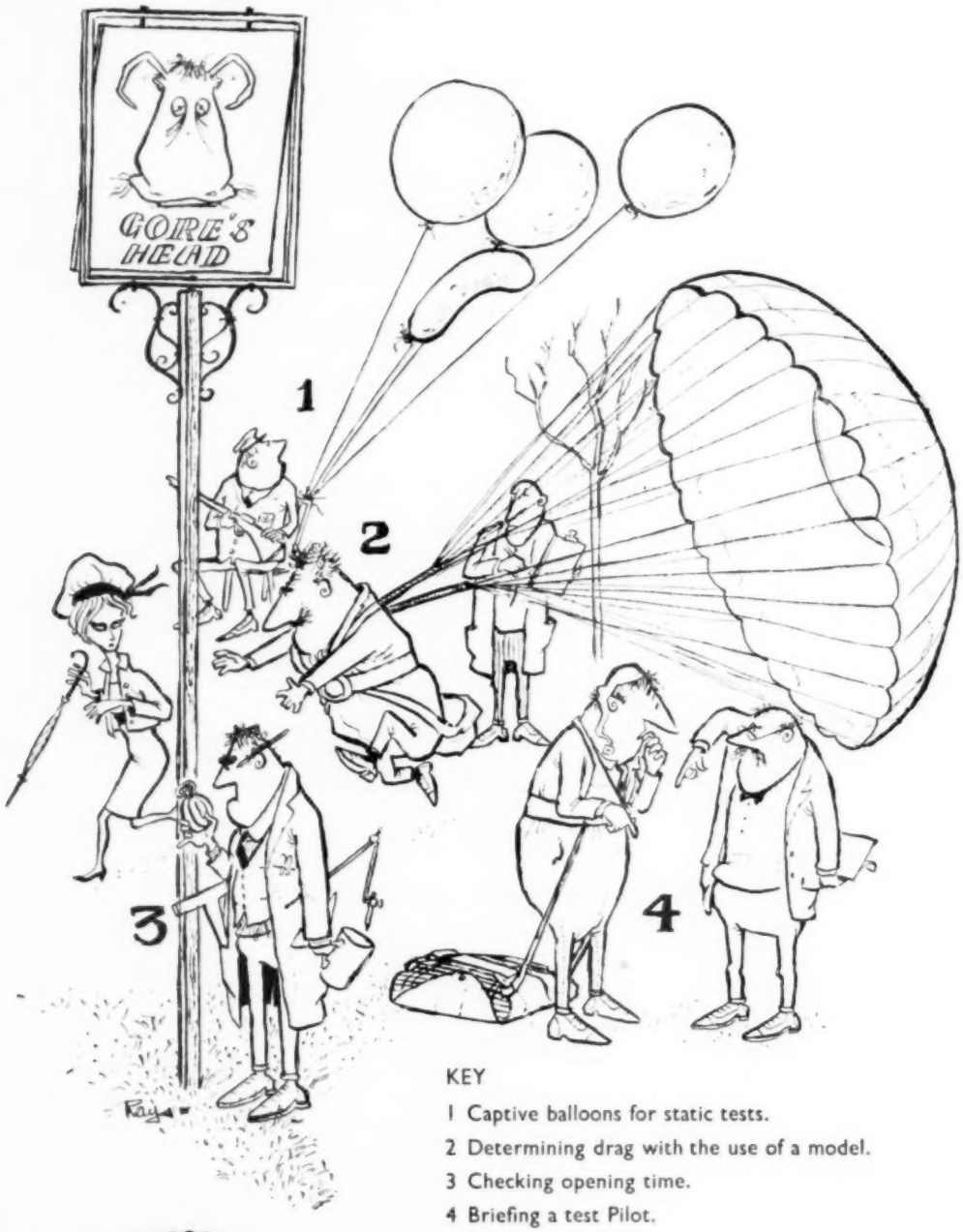
Parachutests I



KEY

1 Captive balloons for static tests.
2 Determining drag with the use of a model.
3 Checking opening time.
4 Briefing a test Pilot.

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Air Transport . . . .

Testing B.O.A.C.'s Boeing 707

DETAILS have been given by Boeing Airplane Co. of the flights made by the B.O.A.C. Conway-engined 707-436 in the course of its F.A.A. functional and reliability trials at the end of September. In the course of four days, this 707 flew more than 12,000 miles, including a non-stop flight from Seattle to Tokyo, a 90-minute local demonstration flight at Tokyo, and the return to Seattle via Honolulu.

The aircraft carried a total complement of 57 crew and passengers. Details of the three flights are given below:—

	Seattle–Tokyo	Tokyo–Honolulu	Honolulu–Seattle
Distance, naut. miles ..	4,181	3,493	2,381
Time, hr: min.	10:47	6:52	5:11
Gross take-off wt., lb. ..	302,000	272,000	274,500
Landing wt., lb.	162,300	175,500	176,500
Fuel remaining, lb. ..	16,000	26,500	28,500
Av. ground speed, knots	387	506	462
Max. ground speed, knots	490	—	—
Av. headwind, knots ..	77	−24	32
Max. altitude, ft.	40,000	33,000	29,000

Delivery of this first B.O.A.C. 707 is now expected to be two or three weeks after the contract date of December 31. The delay is mainly attributable to some additional flights required by the A.R.B. to demonstrate characteristics which are not part of the F.A.A. test schedule.

More Work for the F.A.A.

IN fulfilment of its responsibilities under the Federal Aviation Act of 1958, the F.A.A. is now preparing to assume the task of operating some 2,095 military air-traffic control facilities. This new responsibility will require the F.A.A. to recruit 9,000 air-traffic controllers and 6,000 maintenance technicians.

Known as Project Friendship, this plan has been in preparation since May, 1959, when the Agency began discussions with the Department of Defense to establish which military functions of air navigation and air-traffic control should be transferred to the agency. Mr. E. R. Quesada, F.A.A. administrator, has listed the nine tasks of Project Friendship as follows:—

1. To identify air navigation and air-traffic control facilities and services suitable for F.A.A. assimilation.
2. To develop personnel training requirements.
3. To develop a support programme.
4. To study the requirements for assimilating D.o.D. flight-inspection functions.
5. To develop a programme for assimilating certain military flight service functions.
6. To design a programme for performing appropriate D.o.D. activities in overseas areas.
7. To determine F.A.A.'s research and development requirements in connection with the transferred military activities.
8. To develop budget estimates.
9. To prepare adequate personnel legislation necessary before the military services can relinquish certain of their facilities.

The 2,095 military facilities scheduled to be taken over by the F.A.A. are located at 337 different sites, of which 98 are in 17 foreign countries. Consequently, the success of the programme depends on agreements being reached with foreign authorities, in addition to the goodwill of the military authorities and the necessary budgeting arrangements. The F.A.A. estimates that it will need only 13,330 personnel, including 3,500 overseas, to replace the 20,000 military personnel now employed at these sites.

Major problems in this important programme will be recruiting and training the new personnel over the next five years. Some military controllers are expected to become available to the F.A.A., but virtually no maintenance personnel will be able to transfer. The F.A.A. will therefore have to compete with the electronics industry for technicians and engineers, already in short supply, and may have to reduce qualification standards and lengthen the training period.

The entire training programme will be conducted at the Oklahoma City centre, where two new school buildings for facilities training and air traffic management are to be completed by July, 1961. In addition to A.T.C. responsibilities, the F.A.A. will take over some flight-inspection functions from the military, and will acquire additional flight-inspection aircraft and facilities training equipment for VOR, ILS, ARSR, ASR, TACAN and communications equipment.

From Civil Service to Industry

AFTER completing almost 10 years of service as the U.K. director-general of navigational services, Air Commodore W. E. G. Mann, C.B., C.B.E., D.F.C., retired from the Civil Service earlier this month. As D.G.N.S., he has been responsible for development of the U.K.'s air traffic control systems, telecommunications, fire service, technical development of airports, and ground services generally, at a time when all these have been the subject of rapid change and development.

Air Cdre. Mann joined the R.N.A.S. in April 1917 and served with Nos. 8 and 208 Squadrons in France, being credited with 16 enemy aircraft destroyed and winning a D.F.C. His subsequent service with the R.A.F. included instructing at the C.F.S., service in Iraq, and command of the Air Fighting Development Establishment at Northolt. From 1939 to 1942 he was chief signals officer in the Middle East, and thereafter specialized in signals duties with the R.A.F., as Air Signals Officer-in-Chief under General Eisenhower in North Africa and S.A.S.O., 26 Signals Group.

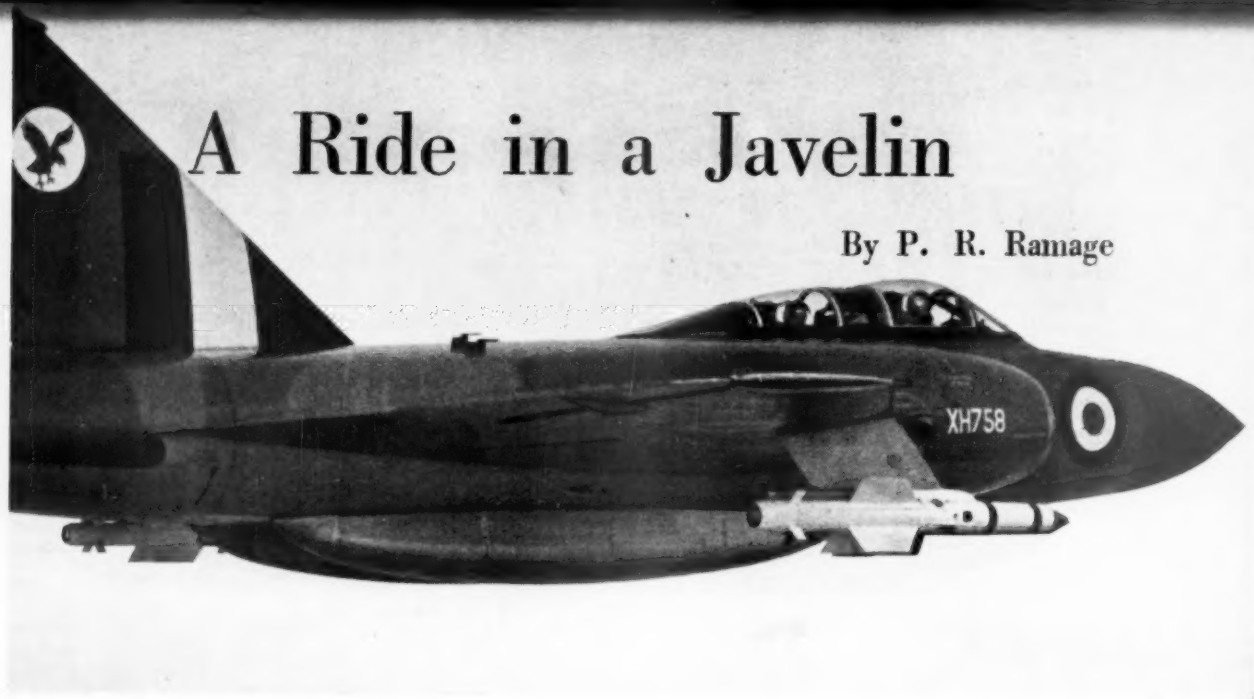
On retiring from the R.A.F. in 1945, Air Cdre. Mann joined the M.C.A. as senior signals officer and became responsible for converting wartime R.A.F. telecommunications facilities in the Middle East to meet the needs of civil aviation. His subsequent appointments were as assistant director (overseas), headquarters; divisional telecommunications officer, London and S.E. Division; and director of telecommunications, headquarters. He was appointed D.G.N.S. in January, 1950.

We understand Air Cdre. Mann is joining the Decca Navigator Company.

NORTH AMERICAN VANGUARDS—The first four of 20 Vickers Vanguards for Trans-Canada Air Lines are seen here on the assembly lines at Weybridge with one of B.E.A.'s 20 Vanguards in the adjoining shop (background, right). Number one for T.C.A. is due to fly next February.

A Ride in a Javelin

By P. R. Ramage



TO obtain a good first-hand impression of an up-to-date military fighter during its early days of operational service is always a difficult task for anyone outside the Services, and when there arose recently an opportunity to fly in the latest type to be issued to R.A.F. squadrons, I took advantage of what proved to be an interesting experience.

The particular aircraft in which I was to fly, the Gloster Javelin FAW.7, powered by two Bristol Siddeley Sapphire A.S.Sa.7s, each with a static thrust of 11,000 lb., started to enter squadron service in the early months of this year and represents the first Fighter Command fighter to have air-to-air missiles as its primary weapon.

With its large Sapphires, compared with the 8,300-lb. A.S.Sa.6s fitted to the Javelin Mks. 1 to 6, four de Havilland Firestreak AAMs, two 30-mm. Aden guns and, what is considered by many to be the best available fighter air interception (AI) and navigational radar, the FAW.7 is a good example of a modern all-weather intercepter. Although not a supersonic aircraft, its deployment in conjunction with a good ground early warning radar system and control organization presents a formidable problem to any high-altitude attacker.

One of the first operational units to receive the Javelin FAW.7 was No. 23 Squadron (Wg. Cdr. G. I. Chapman, A.F.C.) at R.A.F. Horsham St. Faith, which re-equipped last April before returning to its parent base of Coltishall (Gp. Capt. H. A. C. Bird-Wilson, D.S.O., D.F.C., A.F.C.). Previously operating Javelin FAW.4s, the Squadron has been continuously in the night all-weather business since it was re-formed after the Second World War with Mosquito NF.30s and NF.36s in August, 1946.

The author dressed for the flight, which was preceded by a good briefing on the operation of the Martin-Baker Mk. 3JS ejection seat fitted in the Javelin FAW.7.

In line with other all-weather squadrons, No. 23 undergoes the standard Fighter Command training syllabus, which provides for a minimum flying target of 20 hr. per month for each two-man (pilot and navigator/radio operator) crew. Approximately 40% of this total is night flying obtained by the normal two-flight squadron establishment with one on "days" and the other on "nights," alternating every week.

By far the major training task is practice interceptions (P.I.s) in conjunction with the local Master Radar Station, and 60% of all sorties flown come under this heading. Weapons training, including ciné, navigational exercises, instrument flying practice and controlled descents with GCA landings make up the remainder of the flying programme. The last-named item, GCA landing, is to be supplemented at Coltishall by ILS in the near future.

For peace-time flying, and with no bearing on the operational flying standard of the Squadron's second-tour (plus) crews, a weather limit of 800 yd. horizontal visibility and a minimum cloud base of 250 ft. is imposed. In addition, no aircraft can take-off without at least one major diversion airfield giving weather actuals and forecasts above this minimum.

In addition to GCA and the present installation of ILS equipment, Coltishall has a 2,500 yd. runway with a Safeland crash barrier at each end. A Javelin simulator is not available on the station and crews have to go elsewhere for ground emergency and procedure training.

On the practical side of airborne safety equipment, however, No. 23 Squadron has a certain Flg. Off. Peter Baigent, who has twice used the Martin-Baker ejection seat "in anger." Once from a Javelin FAW.4 and the other time from a Mk. 7.

The Firestreak in Service

The introduction of the Javelin FAW.7 with four Firestreaks has had no effect on the handling qualities of the aircraft. Tests with any permutation of AAM positioning, including asymmetric flying with two missiles on the dead engine side, have not presented any major problems.

From the Squadron angle the new weapon has brought a number of changes to the training programme as well as new interest. Two types of Firestreak missiles have been issued—dummy drill rounds and "acquisition" rounds—for ground and air training respectively. No. 23 Squadron has not undertaken any live firings yet and the number of missiles to be fired by a crew during a year or an operational tour has yet to be established.

Two factors, (i) range availability and (ii) target and weapon cost, will tend to limit the number of firings possible by United Kingdom squadrons. But this is not considered a major problem as acquisition training will provide all the necessary instruction required for operational efficiency, although live firing experience would be a bonus.

The Firestreak, powered by one solid-fuel rocket with a 2-3 sec. burning time, can be launched at ranges from under ¾ to 4 miles, depending upon conditions, and can climb 10,000 ft. to intercept a target flying above the fighter. Fitted with both proximity and contact warhead fusing, it has a speed

The Fighting Services

of over Mach 2 and can be fired over fairly large angles to the target from dead astern to well out on the beam.

Aircraft armed with the AAM have a control panel in the pilot's cockpit which contains a switch for energizing the missile from its power supply. When this switch is operated a lamp above it lights; it goes out as soon as the missile is warmed up. The number of Firestreaks to be launched can also be selected.

A lamp lights up when the aircraft's radar has locked onto the target, and another lamp lights up when the missile's infra red homing head has also locked on. As soon as this happens one or all missiles can be launched using the normal armament firing button.

A Demonstration Sortie

My flight demonstrated in general terms the fighter's overall performance and handling qualities. It included a typical ground controlled interception for AAMs, followed by a ciné gun attack down to 200-300 yd., and a GCA.

For take-off in the Javelin the two Sapphires are opened up to 80% power against the brakes before rolling, which with the increase to 100% on moving, gives a very considerable rate of acceleration down the runway. Unsticking at around 135-150 kt. according to the all-up weight, the fighter soon obtains its high optimum indicated climbing speed which is maintained until the best Mach number for the climb is reached. This relatively high subsonic figure was flown all the way up to the demonstration interception altitude of 36,000 ft. Reached within a very few minutes, this particular height was selected so that vapour trails would help in the spotting of our interceptor.

Controlled by the local Master Radar Station, the interception techniques using air-to-air missiles are different, as they obviously would be, to the curve-of-pursuit tactics of cannon-equipped fighters. But since the target must provide a heat-source for the operation of Firestreaks guided by infra-red homing, an astern attack is still necessary.

Once the fighter has confirmed that it has made AI contact with the right target, the ground controller stops passing directions and relevant information on the movement of the target and the crew complete the interception on their own. Automatic "lock/follow" radar gear is employed with radar ranging; both missiles and Aden guns can be fired blind without any visual contact with the target. Line-of-sight adjustments are made by means of a collimator which is fitted in the front cockpit with the gyro-gunsight.

Left to right, Plt. Off. J. R. Wheeler (navigator) and Flt. Lt. D. L. Holmes (pilot) talking to Ch. Tech. R. Sheridan (armament fitter). A dummy Firestreak round is being handled in the background.

In the demonstration interception, for which my Javelin, piloted by Flt. Lt. Peter Botwright, acted as target, the intercepting Javelin passed above and in front, but a successful attack was completed by the use of an "over-shoot" procedure. This has been developed primarily for overcoming possible inaccuracies in an interception during night or blind flying conditions.

One thought that entered my mind during this interception was the cold North Sea. The wearing of the new one-piece Fleet Air Arm aircrew immersion suit would certainly increase my peace of mind if I were in the interception business over so much water for so long.

The elevators, rudder, mass-balanced ailerons, flaps and air brakes of the FAW.7 are of conventional construction and all the primary flying control surfaces are operated by normal cockpit controls. The large slotted-plate type air-brakes located on top and bottom inner wing surfaces can be used at any speed, but are limited in operation above 430 kt. Below this speed, or if opened above and the aircraft has been slowed down sufficiently the fully open air-brakes are very effective.

The tailplane is hydraulically operated with the elevators

Two Javelins of No. 23 Squadron with undercarriage and flaps down. The two 250-gal. fuselage drop tanks and four Firestreak AAMs are normally carried on all sorties.

The Fighting Services . . . .

acting as anti-balance tabs. Trimming of the tailplane is by an electric actuator operated through a thumb switch on the control column. There is also a pitch auto-stabilization system.

Fully powered hydraulic control is used to operate the rudder, which has a very good yaw stabilizer. With the yaw damper system switched off, the aircraft takes a considerable time to settle down after rudder has been applied.

Generally accepted as a very pleasant aircraft to fly, with good handling characteristics, the FAW.7 does not have an autopilot, although a Sperry system is to be installed at a later date. This will be an electro-hyoraulic three-axis system with automatic approach and altitude control.

Single-engine performance does not present any problems as all asymmetric rudder loads can be trimmed out and the main Service restriction to the aircraft is no aerobatic manœuvres in the looping plane. This limitation has been introduced as a safety precaution because of the extreme trim changes as the air speed reduces in the vertical position during the pull-up. This makes it very difficult to judge the load on the control column.

Fairly high *g* loads can be pulled at altitude at high subsonic speeds and the stall-warning system can be made to operate without a great deal of trouble. A very loud buzz in the earphones, it is easily recognizable to both pilot and navigator.

With air brakes out and minimum power the maximum rate of descent from altitude is again very high and the main restriction seems to be the crew's ears. But the normal return to base is by means of a controlled descent from a radar selected point in space, or GEE letdown, followed by a GCA approach and landing. Under these conditions the final approach is made at approximately 160 kt., reducing to 125-130 kt. over the hedge. Full flap produces a strong drag component and a minimum as well as a maximum lowering speed has been set.

Our landing, made in fairly good conditions, was extremely smooth and brought to an end a very pleasant ride in the back seat. Talking to the Squadron pilots afterwards, they made one particular point, the good de-misting and rain dispersal systems fitted to the windscreen—important and appreciated factors for all-weather flying.

Medical Aid at Sea

FOLLOWING the withdrawal of flying boats from R.A.F. service a new technique has been developed for providing medical aid to emergency cases at sea. This consists of the doctor parachuting into the sea alongside the ship and treating the patient on board.

A team of medical personnel led by Wg. Cdr. G. Thomson has been testing equipment during practice parachute jumps into the sea from the F.E.A.F. Survival and Parachute School at Singapore. Wg. Cdr. Thomson, who is senior medical officer in the volunteer parachute rescue team, has completed a total of 50 jumps, including three into the sea with 65 lb. of medical equipment and surgical instruments in special water-proof bags slung beneath him.

In one sense this new method is an advance on the old practice of flying-boats alighting near ships in order to transfer doctors. Whereas aircraft needed calm sea conditions, the medical team are able to make their daylight drop in all but the most adverse weather. The technique is for the whole team to land in the water within 50 yd. of the ship, inflate their dinghies, haul in their equipment and wait to be picked up in the ship's boat.

Long-term Recruiting

DUE to the restriction on the number of men allowed to enlist on short-term engagements, regular recruiting in the R.A.F. during the past nine months dropped by nearly 3,000. But the number of men enlisting for five years or more has increased by 1,500, or just under 25%. There has also been a continuous increase in the extensions of service, and this year it has been approximately 17% better than it was in 1958.

Altogether, there has been a substantial rise in the long-term manpower in the R.A.F. Over 50% of airmen strength on September 30 were engagements of nine years or over.

Gallantry Award

ACTING SERGEANT M. CHILDS, of R.A.F., Dishforth, has been awarded the B.E.M. for gallantry in the air during a crash of a Transport Command Hastings in which he was flying as air quartermaster.

The transport crashed and caught fire shortly after taking-off from Khartoum on May 29, 1959, following an engine failure and violent juddering. Restoring confidence amongst his passengers and preparing them for the crash landing, Sgt. Child's quick action after the crash and subsequent fire helped to get everyone clear of the aircraft. The last man to leave, he brought out another N.C.O. who had been dazed by a falling stretcher post.

R.A.F. Regiment Squadron Standard

A SECOND R.A.F. Regiment Unit, No. 2 (Field) Regiment, received its Standard in Malta on November 25. The Standard was presented at R.A.F. Ta Kali by Air Chief Marshal Sir Hubert Patch, C.-in-C., British Forces Arabian Peninsula.

Formed at Heliopolis (Egypt) in 1922, No. 2 Armoured Car Company saw active service in Transjordan and Palestine. With No. 14 Squadron, it was engaged in tribal actions in Transjordan, and during the 1936-1939 Palestine disturbances operated in support of the civil police and military forces. A section of the Company served with General Wavell's ground forces during the first offensive in the Western Desert, being joined by the remaining sections the following year. The Company fought in the 1943 Rashid Ali rebellion in Iraq. At the end of the North Africa campaign it returned to Egypt, subsequently moving to Transjordan and Palestine on internal security duties until 1945.

Incorporated into the R.A.F. Regiment in October, 1946, it became No. 2 (Field) Squadron seven years later.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Gp. Capt. D. H. Burnside, D.S.O., O.B.E., D.F.C., to the Department of the Air Member for Supply and Organization; Wg. Cdr. I. N. Gundry-White, D.F.C., and Wg. Cdr. R. C. Cobbe, D.S.O., O.B.E., both to the Department of the Chief of the Air Staff.

Bomber Command: Gp. Capt. B. D. Sellick, D.S.O., D.F.C., to R.A.F. Upwood to command; Gp. Capt. W. A. Theed, A.F.R.Ae.S., to Headquarters as Command Armament Officer; Wg. Cdr. J. H. Hoskins, D.S.O., D.F.C., to Headquarters No. 3 Group in charge of training.

Fighter Command: Wg. Off. D. B. van Donop, W.R.A.F., to Headquarters as Command W.R.A.F. Administrative Officer.

Coastal Command: Sq. Ldr. J. R. Ramsden, A.F.C., to R.A.F. St. Mawgan to command No. 42 Squadron, with the acting rank of Wg. Cdr.

Flying Training Command: Wg. Cdr. R. H. Blackmore to R.A.F. Church Fenton to command; Wg. Cdr. A. C. Smith to Headquarters for administrative duties.

Technical Training Command: Wg. Cdr. A. E. W. Laband to No. 4 School of Technical Training, R.A.F. St. Athan, to command the Boy Entrant Wing.

Maintenance Command: Gp. Capt. E. A. Stockwell, M.A., A.F.R.Ae.S., to Headquarters as Command Education Officer; Wg. Cdr. T. J. da C. Andrade, O.B.E., to R.A.F. Fauld to command No. 21 Maintenance Unit.

Middle East Air Force: Gp. Capt. W. J. Maggs, O.B.E., M.A., to Headquarters as Senior Equipment Staff Officer.

British Forces Arabian Peninsula: Wg. Cdr. D. Nelson to Headquarters as Command Armament Officer; Wg. Cdr. E. B. Sismore, D.S.O., D.F.C., A.F.C., to Headquarters for joint planning staff duties.

Other Appointments: Gp. Capt. A. H. W. Ball, D.S.O., D.F.C., to the British Joint Services Mission, Washington; Gp. Capt. D. D. Haig, D.S.O., D.F.C., to the United States on an exchange position with the U.S.A.F.; Wg. Cdr. K. McK. Murray, D.F.C., to the United States for duties with N.A.T.O.; Sq. Ldr. H. J. Cobb, D.S.O., D.F.C., A.F.C., to Boscombe Down, to command the Handling Squadron, with the acting rank of Wg. Cdr.

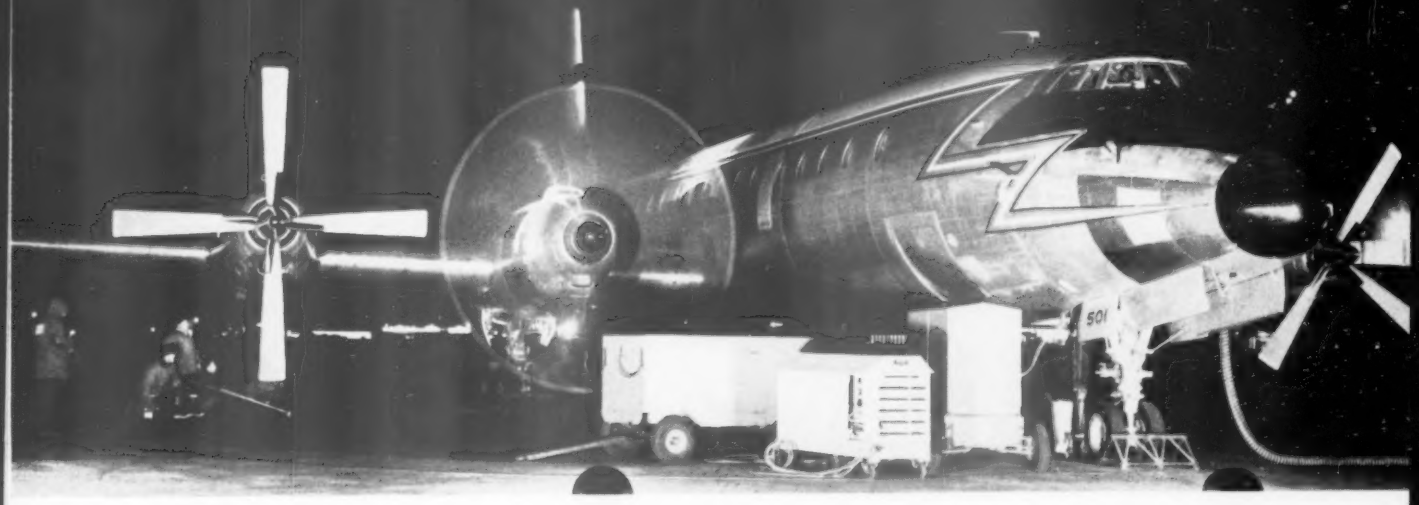
No. 54 Squadron Reunion.—A reunion dinner for past and present officers of No. 54(F) Squadron will be held at R.A.F. Stradishall on, or about, January 16, 1960. Particulars may be obtained from the Adjutant, No. 54(F) Squadron, R.A.F. Stradishall, Newmarket, Suffolk.

No. 608 Squadron.—The Standard of No. 608 (North Riding) Squadron, R.Aux.A.F., was laid up in York Minster on November 14. It was handed over to the Dean by the Earl of Swinton, former honorary Air Commodore of the Squadron.

No. 23 Squadron History.—It is hoped to publish the history of No. 23 Squadron before the end of 1960, and any ex-members who are interested in buying a copy, price under £1, are asked to contact Flt. Lt. R. I. Campbell at 2 Barnby Road, Coltishall, Norwich, Norfolk. Any material of value to the compilation of the book is still welcome, particularly anecdotes or captioned photographs.

R.N.Z.A.F. Operations.—Since it started operating in Malaya, No. 41 Squadron, R.N.Z.A.F., flying Bristol Freighters, has dropped nearly 3,000,000 lb. of food and equipment to security ground forces in the jungle. No. 75 Squadron, R.N.Z.A.F., operating Canberras, has dropped 75,000 lb. of bombs in support of the ground forces.

Canadair's Big Freighter



FIRST flight of the Canadair CL-44 turboprop transport was made on November 15 and lasted more than two hours. This aircraft—the largest ever built in Canada—has been developed initially as the CC-106 military transport for the R.C.A.F., but it has made history in its civil rôle as the first modern aircraft to be ordered by airlines as a pure freighter. To date, 15 civil CL-44s have been ordered by the two leading all-freight operators in the United States, Flying Tiger and Seaboard and Western. Details of the orders and of the variants of the CL-44 to be produced were given in our issue of October 16. Twelve military CL-44s have been ordered by the R.C.A.F.

The CL-44 is based on the Britannia, following an agreement between the Bristol Aeroplane Co. (as it then was) and Canadair, made in 1957. This new transport, however, is 12 ft. longer than the Britannia 310 and has Rolls-Royce Tyne turboprops in place of the Britannia's Proteus engines. It will enter service at an all-up weight of 205,000 lb., compared with 185,000 lb. for the Britannia 310.

Canadair anticipates that by 1963 increases in the power of the Tyne will allow the CL-44E version of this transport to operate at weights up to 234,000 lb. and carry a payload of more than 100,000 lb. As a passenger transport the initial civil version of the CL-44 will carry a maximum of 184 passengers.

Low Costs and Ease of Loading

Two features of the CL-44 which give it particular appeal to air-freight operators are its low operating costs and its "swing tail" fuselage, which permits rear-loading of freight. The swing tail will be incorporated only on civil CL-44s. The earlier military transports will have conventional large side doors for freight loading.

Direct operating cost per ton-mile of the CL-44 is claimed to be 40% lower than for the best current freight aircraft. In addition, it offers a combination of payload, range and speed which should allow operators to make the very most of the potential market for air freight—a market which has been increasing more rapidly than the demand for passenger transport by air.

The initial civil version of the CL-44 will be able to carry its maximum payload of 65,000 lb. over a range of 2,844 miles cruising at 392 m.p.h., with a 2-hr. fuel reserve. With the same reserves it will carry 47,400 lb. over 4,490 miles.

Civil CL-44s are offered in three versions—as a cargo transport, as a passenger aircraft, and as a convertible cargo/passenger aircraft. Only the all-cargo and convertible versions have so far been ordered, but Canadair studies have shown that in certain cases the passenger version could compete on a pure cost basis with surface transport. For instance, it is claimed that between Toronto and Vancouver the CL-44 would break even with a 50% load factor even if the fares charged were only 52% of the current rail fare.

On the military transport there are two large doors in the port side of the fuselage, the forward one measuring 93 in. x 73 in. and the rear one, 120 in. x 78 in. As we have said, in the commercial versions the rear cargo door is replaced by the hinged tail.

This arrangement was chosen by Canadair as the best solution to operators' demands for an efficient loading system. As well as allowing straight-in loading of the main cargo hold, the hinged tail gives direct access to the rear underfloor baggage hold.

Hinging the tail avoided changing the aerodynamic shape of the CL-44; if a nose or under-tail loading system had been chosen, there would inevitably have been resulting weight and drag penalties. In fact, Canadair have stated that the hinged-tail system has structural advantages over the conventional large side door, which requires extensive reinforcement of the surrounding structure.

The tail section of the fuselage is carried on two large external hinges on the starboard side of the fuselage and the swing section is opened and closed by a telescoping hydraulic actuator mounted in the fin fillet. The tail is locked in the closed position by eight latches designed to take longitudinal loads and by 12 shear wedges which transmit torsion loads.

There are hydraulically actuated pins at the latch positions of the tail-section box frame. When the tail is closed these pins, mounted in jack fittings, pick up with tongue fittings in the forward fuselage. Movement of the pins is sequenced by a micro-switch when the fuselage is closed.

A system of this type demands thorough safety measures. Each locking pin operates a micro-switch when it reaches the end of its travel and when all pins are fully home an electrical circuit is completed to give a visual indication to the pilot. The latching-pin jacks have internal hydraulic locks which engage when the jacks are fully extended. The pins themselves also lock on the "pip-pin" principle, thus providing a secondary safety feature if the jack lock were to fail.

It is impossible to select "unlatch" in flight because the hydraulic line to the actuator and locking pins is disconnected and stowed by a ground-crew member before flight. This is done at a point on the outside of the aircraft; the system is designed to prevent disconnection unless the latching pins are locked home.

This disconnection isolates the hydraulic fluid in the main tail-swinging jack and the latch-pin jacks. It also switches off the pilot's indication that the tail is locked and disconnects a throttle lock which prevents the engines from being opened

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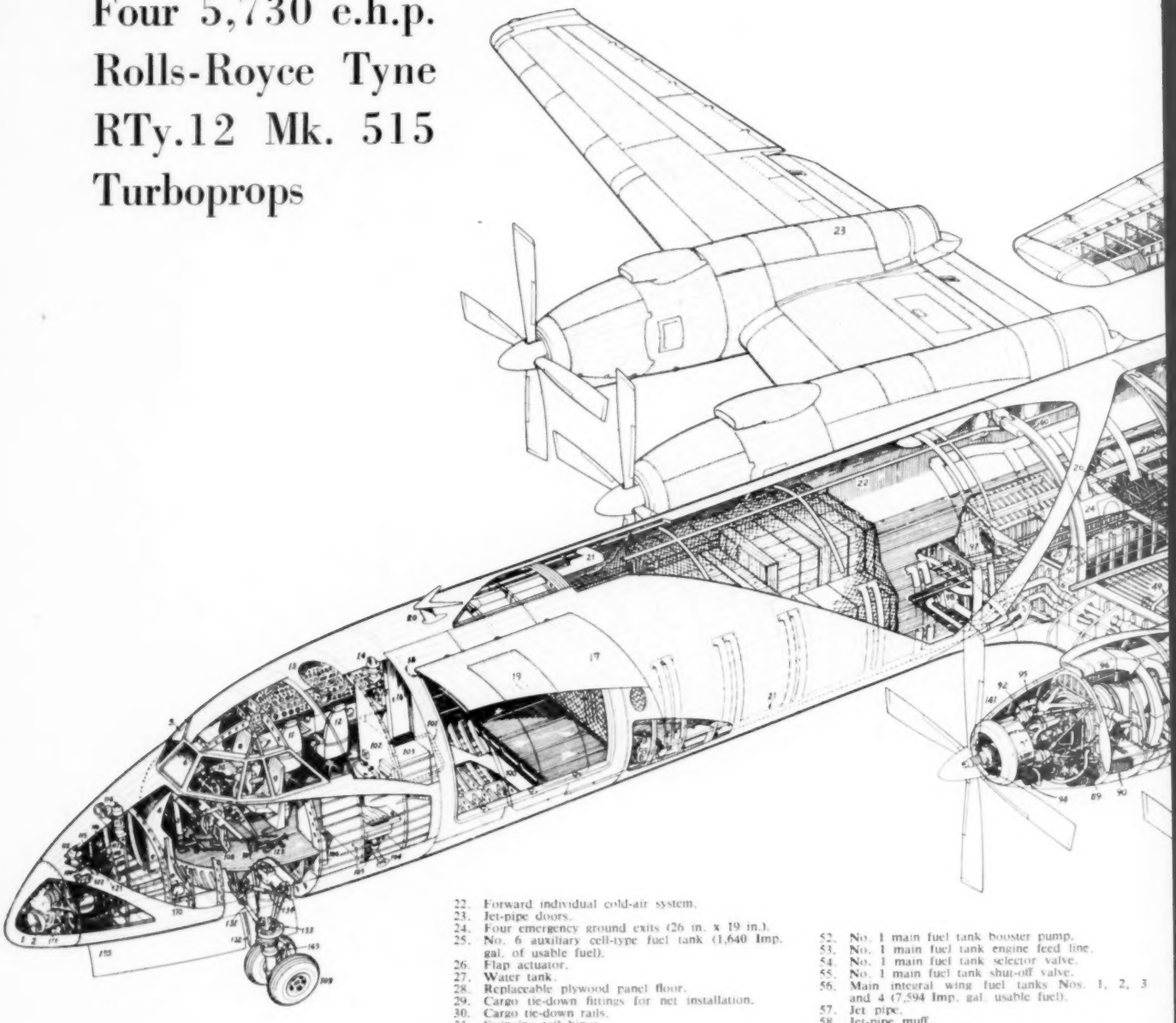
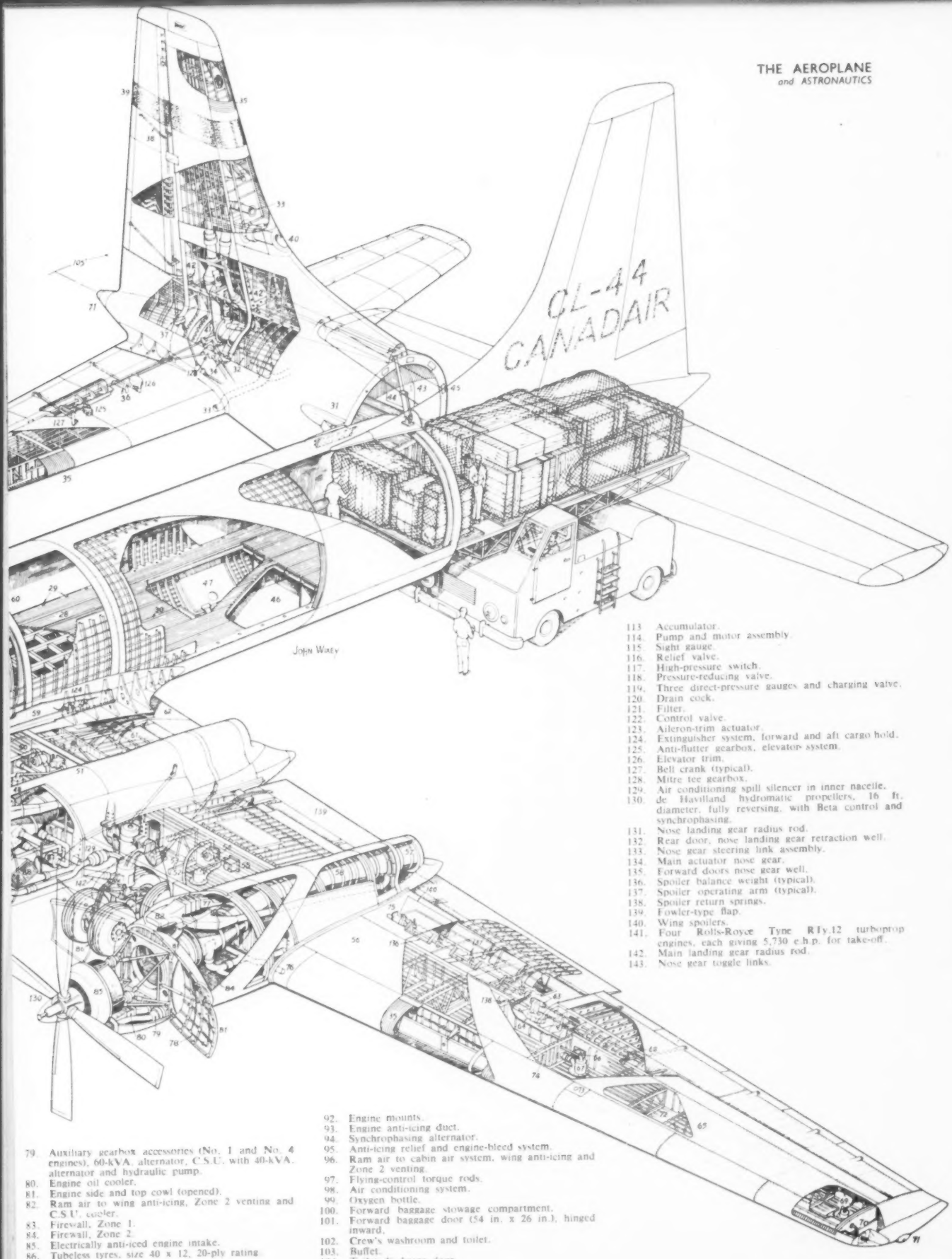
CANADAIR CL-44D

Four 5,730 e.h.p. Rolls-Royce Tyne RTy.12 Mk. 515 Turboprops



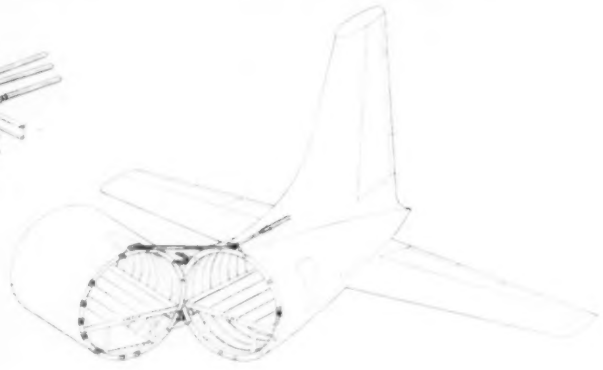
KEY

1. Radome.
2. Radar antenna.
3. Dual control column.
4. Forward spherical pressure-dome.
5. Laminated windscreen with electrical anti-icing.
6. Anti-dazzle shroud.
7. Engine control pedestal.
8. Co-pilot's seat.
9. Pilot's seat.
10. Pilot's and co-pilot's instrument panel.
11. Systems operator's position.
12. Radio operator/navigator's position.
13. Ditching hatch (26 in. x 19 in.) hinged inward.
14. Periscopic sextant.
15. Junction box.
16. Two five-man dinghies and coat storage.
17. Forward cargo door (93 in. x 75 in.).
18. Forward cargo door seal.
19. Crew's forward entrance door.
20. VHF/VOR antenna.
21. Main forward distribution air-conditioning ducts.
22. Forward individual cold-air system.
23. Jet-pipe doors.
24. Four emergency ground exits (26 in. x 19 in.).
25. No. 6 auxiliary cell-type fuel tank (1,640 Imp. gal. of usable fuel).
26. Flap actuator.
27. Water tank.
28. Replaceable plywood panel floor.
29. Cargo tie-down fittings for net installation.
30. Cargo tie-down rails.
31. Swinging tail fin.
32. Aft pressure bulkhead.
33. Leading edge anti-icing duct from combustion chamber.
34. Variable-ratio screw jack for elevator control tab.
35. Leading edge with thermal anti-icing.
36. Elevator servo tab mechanism.
37. Variable-ratio screw jack for rudder control tab.
38. Rudder servo tab mechanism.
39. Dielectric section.
40. Anti-icing and combustion heater air intake.
41. Combustion heater.
42. Vertical stabilizer attachment points.
43. Aft entrance door.
44. Hydraulically operated actuator for swinging tail.
45. Tail joint locks.
46. Rear baggage stowage compartment.
47. Rear baggage door (54 in. x 26 in.) hinged inward.
48. No. 2 main fuel tank booster pump.
49. No. 2 main fuel tank engine feed line.
50. No. 2 main fuel tank selector valve.
51. No. 2 main fuel tank shut-off valve.
52. No. 1 main fuel tank booster pump.
53. No. 1 main fuel tank engine feed line.
54. No. 1 main fuel tank selector valve.
55. No. 1 main fuel tank shut-off valve.
56. Main integral wing fuel tanks Nos. 1, 2, 3 and 4 (7,594 Imp. gal. usable fuel).
57. Jet pipe.
58. Jet-pipe muff.
59. Wing/fuselage reinforced attachment plate.
60. Wing fuselage main horseshoe frames.
61. Outboard flap screw-jacks.
62. Outboard flap-guide rails.
63. Variable-ratio screw-jack for aileron control tab.
64. Aileron inboard tab and rudder connecting bevel box.
65. Auxiliary outboard integral wing fuel tanks Nos. 5 and 7 (916 Imp. gal. usable fuel).
66. No. 5 auxiliary fuel tank fuelling valve.
67. No. 5 auxiliary fuel tank booster pump.
68. Aileron servo-tab mechanism.
69. No. 5 auxiliary fuel tank level-control valves.
70. No. 5 auxiliary fuel tank vent.
71. Navigation lights.
72. Typical braced rib.
73. No. 5 auxiliary fuel tank filling point.
74. Bulkhead between No. 1 and No. 5 integral wing fuel tanks.
75. Electric actuator for spoiler.
76. Leading edge anti-icing from jetpipe muff.
77. C.S.U. cooler.
78. Fire-extinguishing system.



113. Accumulator.
114. Pump and motor assembly.
115. Sight gauge.
116. Relief valve.
117. High-pressure switch.
118. Pressure-reducing valve.
119. Three direct-pressure gauges and charging valve.
120. Drain cock.
121. Filter.
122. Control valve.
123. Aileron-trim actuator.
124. Extinguisher system, forward and aft cargo hold.
125. Anti-flutter gearbox, elevator system.
126. Elevator trim.
127. Bell crank (typical).
128. Mitre tee gearbox.
129. Air conditioning spill silencer in inner nacelle.
130. de Havilland hydromatic propellers, 16 ft. diameter, fully reversing, with Beta control and synchrophasing.
131. Nose landing gear radius rod.
132. Rear door, nose landing gear retraction well.
133. Nose gear steering link assembly.
134. Main actuator nose gear.
135. Forward doors nose gear well.
136. Spoiler balance weight (typical).
137. Spoiler operating arm (typical).
138. Spoiler return springs.
139. Fowler-type flap.
140. Wing spoilers.
141. Four Rolls-Royce Tyne RTy.12 turboprop engines, each giving 5,730 e.h.p. for take-off.
142. Main landing gear radius rod.
143. Nose gear toggle links.

79. Auxiliary gearbox accessories (No. 1 and No. 4 engines), 60-kVA. alternator, C.S.U. with 40-kVA. alternator and hydraulic pump.
80. Engine oil cooler.
81. Engine side and top cowl (opened).
82. Ram air to wing anti-icing, Zone 2 venting and C.S.U. cooler.
83. Firewall, Zone 1.
84. Firewall, Zone 2.
85. Electrically anti-iced engine intake.
86. Tubeless tyres, size 40 x 12, 20-ply rating.
87. Refrigeration turbine.
88. Secondary heat exchanger.
89. Auxiliary gearbox accessories (No. 2 and No. 3 engines). No. 2 engine: Cabin supercharger, C.S.U. with hydraulic pump and 40 kVA. alternator. No. 3 engine: Cabin supercharger and 60 kVA. alternator.
90. Cabin supercharger.
91. Low-pressure bleed exhaust.
92. Engine mounts.
93. Engine anti-icing duct.
94. Synchrophasing alternator.
95. Anti-icing relief and engine-bleed system.
96. Ram air to cabin air system, wing anti-icing and Zone 2 venting.
97. Flying-control torque rods.
98. Air conditioning system.
99. Oxygen bottle.
100. Forward baggage stowage compartment.
101. Forward baggage door (54 in. x 26 in.), hinged inward.
102. Crew's washroom and toilet.
103. Buffet.
104. Toilet discharge door.
105. VHF antenna.
106. Main distribution panel.
107. Flying-control bevel gearboxes.
108. Rudder control mechanism.
109. Tubeless tyres, size 32 x 8.8, 12-ply rating.
110. Fire extinguishing bottle.
111. Glide-path antenna.
112. Reservoir in nose hydraulic compartment.



SWING TAIL.—Details of the swinging tail mechanism of the CL-44 are shown here. Where control torque tubes cross the break-line, their movement is converted into push-rod action; push-rods on each side of the break butt together when the fuselage is closed.

(*Continued from page* 537)

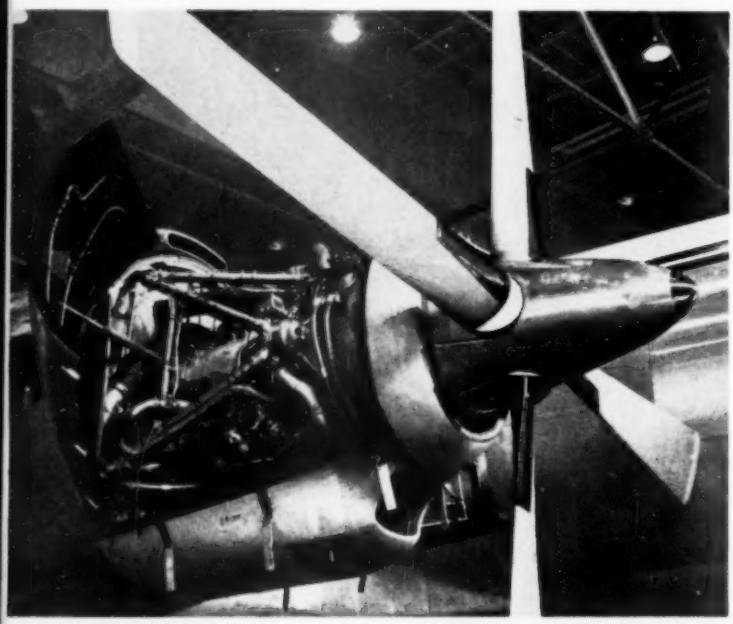
up to take-off power unless all the latches are engaged and locked.

On both sides of each latch there are locating spigots and shear pins which ensure correct alignment of the rear fuselage. Latches and hinges are designed on a fail-safe basis.

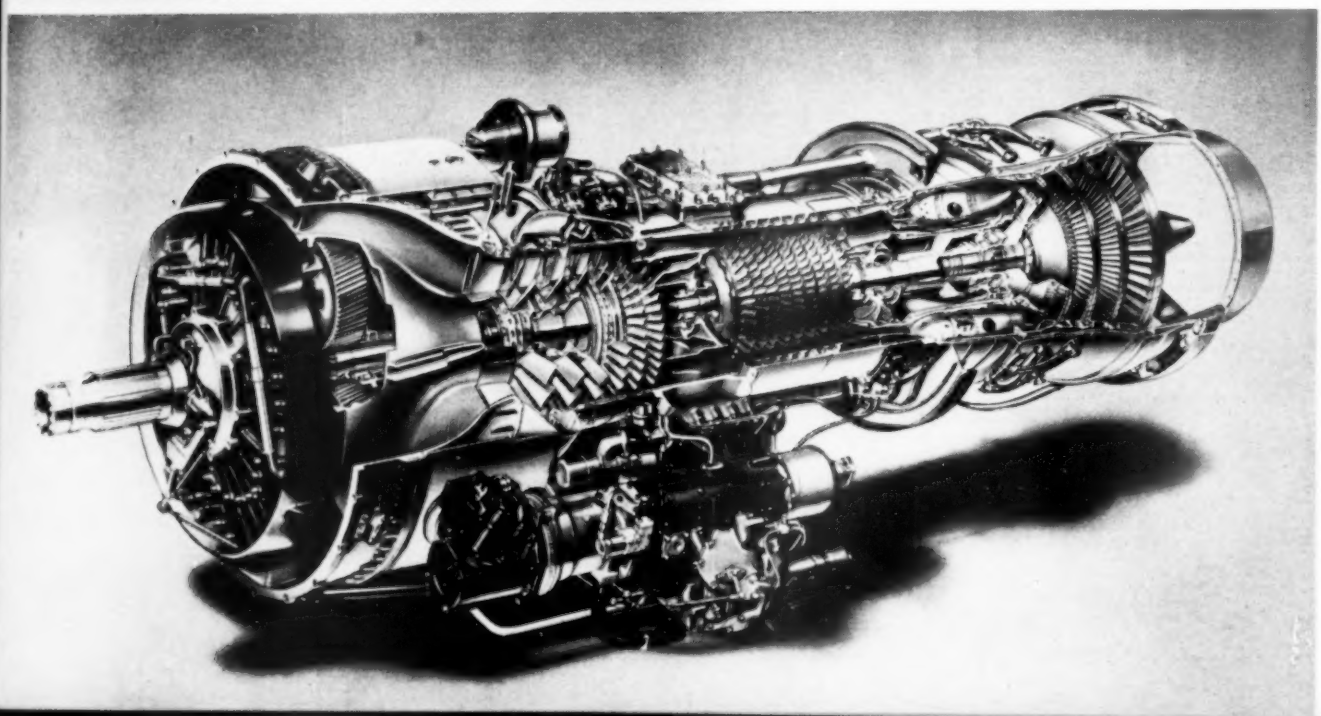
When the fuselage is opened for unloading the hydraulic system must first be reconnected by the ground-crew. This reconnects all the features cut off when the hydraulics were disconnected. The pilot can then select "door open." Initially this loads the door-opening jack to give a closure force which relieves the latch pins of the weight of the tail and allows their easy withdrawal. When each latch pin is fully withdrawn it operates a micro-switch; after all pins have been withdrawn the main jack swings the tail back. The aircraft's hydraulic system can be used for swinging the tail but, if the engines are not running, a ground source of power can be used.

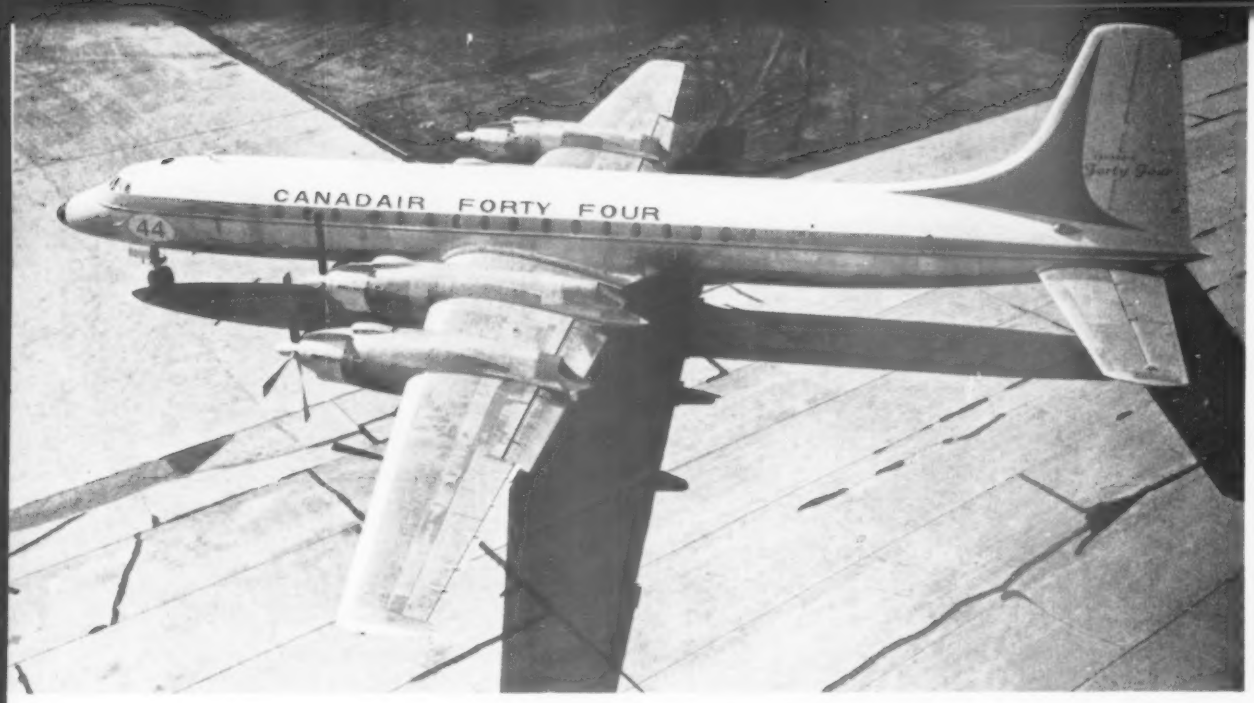
Where the torque tubes for elevator, elevator-trim and rudder controls cross the fuselage break, the control motion is transmitted by a series of bevel gears, levers and rollers. Torque-tube motion is converted to push-rod action and the push-rods on each side of the break butt against each other. Control connections are recessed to prevent damage when the tail is swung open for freight loading. Hydraulic pressure for the control system is carried over the fuselage break-line by flexible links.

Hinges, tail actuator and latches are mounted on a stiffened



ROLLS-ROYCE POWERPLANT.—Tyne RTy.12 engines drive the CL-44's de Havilland propellers (left); a total of 22,920 e.h.p. is available for take-off. Interior layout of the two-spool Tyne is shown below.





structure to keep deflections to a minimum. Cabin-pressure leaks at the joint line are prevented by an inflatable seal.

Dimensions, weights, performance figures and other data for the Canadair CL-44 are as follows:—

DIMENSIONS.—Span, 142 ft. 3 in.; length, 136 ft. 7 in.; height, 36 ft. 8 in.; wing area, 2,075 sq. ft.; cabin length, 98 ft. 7 in.; max. cabin height, 6 ft. 9 in.; max. cabin width, 13 ft. 6 in.; max. usable volume, 6,380 cu. ft.

POWERPLANT.—Four Rolls-Royce Tyne RTy.12 turboprops each giving 5,730 e.h.p. for take-off in I.S.A., sea-level conditions.

WEIGHTS.—Basic operational: domestic cargo, 88,215 lb.; international cargo, 91,009 lb.; convertible 104,252 lb. Total fuel: domestic cargo, 68,410 lb.; international, 81,200 lb. Max payload: domestic cargo, 76,785 lb.; international cargo, 63,991 lb.; convertible, 40,470 lb. Max. take-off, 205,000 lb. Max. landing: domestic cargo, 175,000 lb.; international, 165,000 lb. Max. zero fuel: domestic cargo, 165,000 lb.; international, 155,000 lb.

PERFORMANCE.—Balanced field length, I.S.A., sea-level, at max. t.-o. weight, 7,660 ft. Range in still-air, I.S.A., no reserves, with max. payload: domestic, 2,385 naut. miles; international, 3,220 naut. miles (cargo) or 3,860 naut. miles (passenger). Landing distance at max. landing weight, 7,075 ft. (domestic cargo), 10,700 ft. (international).

CL-44 ORDERS.—Royal Canadian Air Force, 12 CL-44-6 (CC-106); Seaboard and Western, five (with option on another five), CI-44D-4-1; Flying Tiger Line, 10 CL-44D-4-2 and -3; Slick Airways, letter of intent for two and option on four.

Plain Speaking at Derby

TO many visitors the fourth Sir Henry Royce Memorial Lecture read on November 2 before the Derby Branch of the R.Ae.S. and distinguished visitors from other Branches, must have appeared rather a family affair. Leading executives of an airline which has launched two Rolls-Royce engines were talking on "Power for an Airline" to those responsible for providing this power. The lecturers, Mr. B. S. Shenstone, the chief engineer of B.E.A., and Mr. H. G. Rossiter, the Corporation's engine development manager, took the opportunity of stating their views without ambiguity, as these quotes indicate.

"Sir Henry Royce was a perfectionist, a man for whom the best was only just good enough, a feeling that has inspired the rest of Rolls-Royce, Ltd., over many years. That is one of the reasons why B.E.A. is in danger of becoming an all-Rolls-Royce airline, possibly the first of any consequence. And somehow, maybe because of this close association, B.E.A. has become imbued with Sir Henry's perfectionism and is becoming just as difficult to satisfy. . . .

"We are faced, in assessing an engine, with trying to discover what degree of optimism or pessimism is included in the initial design date. With Rolls-Royce our experience is that there is a great initial pessimism which is later balanced—and sometimes over-balanced—by an enthusiastic optimism. What is impossible to do one day becomes accepted the following day, and since as far as we can see you always believe what you say, we have considerable difficulty in discovering the truth, if such exists. . . .

"Engine companies do seem to like overhauling their own engines, and it has been known that they like to do this so much that when airlines consider the advantages of doing their own overhauls, overhaul prices have been substantially reduced by the engine makers. This is no doubt intended as an incentive to keep the overhaul of the engines in the hands of the manufacturers, but it takes no more than a minute's consideration to realize that the incentive is in the other direction. If the business is so good that it is worth keeping at a lower price, it merely underlines the fact that the best thing would be for the airline to do the job itself. . . .

"Do not tell us that components such as fuel control units, fuel pumps, feathering pumps and all the other accessories will not give trouble because they are better than those we had previously. We expect them to be more reliable as the result of your development efforts, but often you introduce more complicated accessories and the more complication you build in, the more chance there is of things going wrong. You cannot convince us on this, so please design to ensure that all accessories are readily accessible and easily removable without the necessity to disturb other accessories or their services. . . .

"We are not being critical here; we know of an installation where a very important accessory somehow was buried by other accessories and it would take a skilled and rather twisted dwarf many hours to remove it. At the production stage it was necessary to introduce many expensive modifications to make the installation acceptable, at least to an operator. . . .

"The way an engine is to be operated is important for the designer to know; it must be understood that a pilot will not spend more than a few moments occasionally setting up engines. . . . The engine must have built into it right from the start a reasonable degree of tolerance. . . . This is the same thing as saying enough margin should be allowed on the working temperature of the material chosen for turbine blades, such that should the temperature vary by as much as 10° either way from the calculated nominal, the minimum blade life of one overhaul period is not reduced.

"We, the airline, have to pay; pay for modifications, pay for overhauls and pay in extra operation cost, if the engines should not come up to expectations. Because of this financial stake that we have in any future engine, we feel that we are able to make a definite contribution towards those factors in the design that we understand.

"We have been told, and this applies to engines as well as other things, 'There are two stages in the details of any design—when it is too early to talk about them, and when it is too late to do anything about it.' How forcibly this is brought home to us sometimes. We know the implications, the headaches and the cost of introducing new equipment into service; we were first with the Viscount and we shall be first with the Vanguard and the D.H.121."

Astronautics and Missiles

Radio-Repeater Satellites

WITHIN the next few years, revolutionary developments in long-distance communication, made possible by the use of artificial satellites, may change astronautics from a science of apparently little practical utility to one of great commercial interest. In both America and Russia, there is talk of the prospects which are opening up for satellites as relay stations for telegraph, telephone and television services, and there seems little doubt that these developments will now be pushed forward with all speed.

How long is Britain to remain a spectator in this field which holds promise of introducing new opportunities for the electronics industry in the provision of the appropriate ground stations, to say nothing of satellite equipment? What a fine argument exists here for expanding our present limited programme of space-research using the de Havilland Propellers' Blue Streak as a satellite launcher.

Passive or Active?

Last week we discussed the prospects of "passive" reflector satellites in radio communications, in particular the 100-ft. dia. balloon-like spheres which NASA shortly propose launching on a 50-deg. inclined orbit at a height of 1,000 miles.

The great advantage of the "passive" satellite is, of course, its inherent simplicity and the fact that a large number of operators in different areas can use the satellite for reflecting radio signals at the same time, without danger of interference, merely by using different frequencies. Experiments are to be made in the 1,000 to 2,000-Mc. range.

Disadvantages of the system are that large, high gain antennas, powerful transmitters and receivers of high sensitivity are needed on the ground, while the use of passive satellites on the desirable 24-hr. "fixed" orbit at 22,300 miles would require spheres of quite enormous dimensions—one estimate suggests between ¼- and ½-mile diameter. Another difficulty is that the passive reflector cannot "store" messages, which limits its utility.

A British Proposal

Although experiments to be made with the 100-ft. inflatable satellites include television, it seems that active repeater satellites will be required for the commercial development of global TV services.

As with so many other fundamental ideas of astronautics, the idea of TV satellites originated in this country. As early as 1945, Mr. Arthur C. Clarke, a past chairman of the British Interplanetary Society, suggested that if three such stations were established 22,300 miles above the equator with 120-deg. spacing, they could provide a global television service. At the chosen height, the satellites would match the Earth's rotation and keep station with points immediately below them on the surface, remaining essentially "fixed" in the sky.

This is exactly the technique the Americans are now planning to adopt with the 24-hr. orbit satellites which the Advance

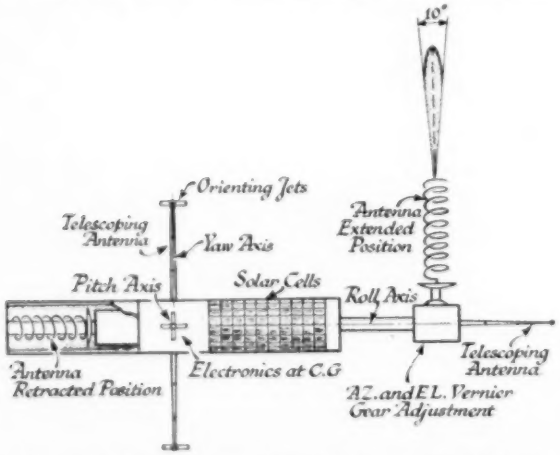
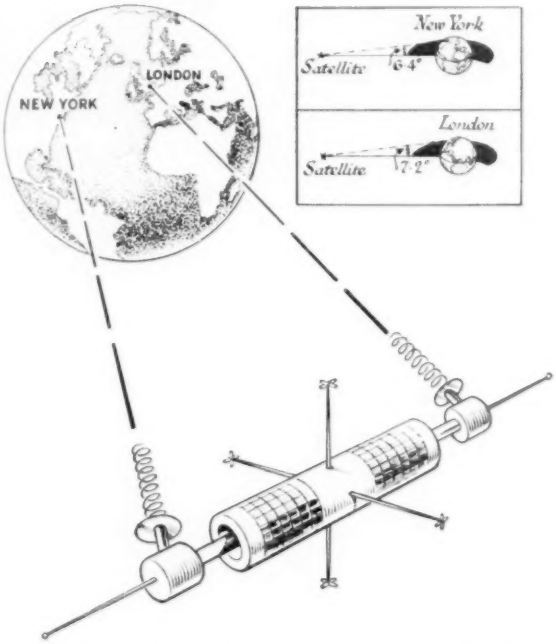


Diagram of the 500-lb. repeater satellite proposed by the Space Electronics Corporation.



Using two ground stations and a repeater satellite established in a 24-hr. equatorial orbit, television programmes could be relayed across the Atlantic.

Research Projects Agency are developing as part of the ABMA-NASA Saturn booster project. An initial U.S. Army project, the Courier low-altitude communication satellite, is scheduled for launching early next year; this, however, is a telegraph communication system which, it is claimed, will transmit six million pieces of information in four minutes.

The object is to provide 20 continuously available 100-word-a-minute teletype channels. As the satellite passes over one station, it will be commanded to transmit information "addressed" to that station while, at the same time, its equipment will record, for later transmission, communications for other stations along its path.

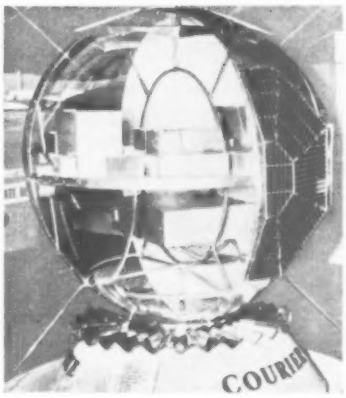
On this basis, Mr. R. P. Haviland of the General Electric Company has suggested that 16 active repeater satellites on a 1,000-mile orbit would provide complete global coverage, as opposed to the use of three 24-hr. orbit satellites at 22,300 miles.

The problem of establishing a 500-mile payload in a 24-hr. orbit is considered in a feasibility study recently completed by the Space Electronics Corporation of Glendale, California.

Launching would be performed by a four-stage version of the Atlas-Vega, comprising a modified Convair Atlas, an improved General Electric Vanguard first stage, and two solid-propellent top stages. The third and fourth stages would be used to transfer the payload from an initial 300-mile orbit to a stable orbit at 22,300 miles, providing sufficient energy for changing the orbit from one which initially is inclined at 28-deg. to the equator to an equatorial orbit.

To achieve maximum economy, Space Electronics have assumed the use of existing missile range facilities, both for launching and, at least, initial guidance. Thus, in their scheme, the ascent would be made under the control of guidance equipment already available at Cape Canaveral, Florida, and San Salvador. Ground facilities at Vandenberg Air Force Base in California would be used for guidance of the third and fourth stages.

A further proposal is that an existing Minitrack station, as developed for the Vanguard radio-tracking network, might be used for the satellites' precise orbital positioning in the 24-hr. orbit. This station would be supplied with a command link for



This sectioned model of the Courier "delayed action" repeater satellite, being developed by the U.S. Army Signal Corps, was shown at a recent exhibition of new communication equipment at Fort Monmouth, New Jersey.

transmitting positioning signals to the vehicle. It is not anticipated that signals would be sent very frequently, and "smoothing times" of the order of days have been assumed.

Ground Stations

Initially, Space Electronics suggest there would be two ground stations, one situated in the vicinity of New York and the other in the London area. Ground stations would consist of a receiver and transmitter, each with a 105-ft.-dia. directional antenna using a carrier frequency of about 1,000 Mc. This, it is assumed, would provide a beam width of 7 deg. and a gain of 50 db. The cost of these stations would work out at about £1 million.

To suit the location of receiving stations in New York and London it would be necessary for the satellite to be established at approximately 37 deg. west longitude above the equator. Tracking radar used for ballistic missiles would be suitable to check the satellite's position to an accuracy within 2½ miles.

In a telecast from the United States to Europe, the programme would come over coaxial or microwave link to a modulator which would convert the signals to the proper code for transmission. Signals would then be transmitted at high power over the 105-ft. antenna to a directional receiving antenna in the satellite. There they would be rebroadcast via another directional antenna to the station in England, which would receive the signals and decode and re-transmit them over the appropriate links to the European networks.

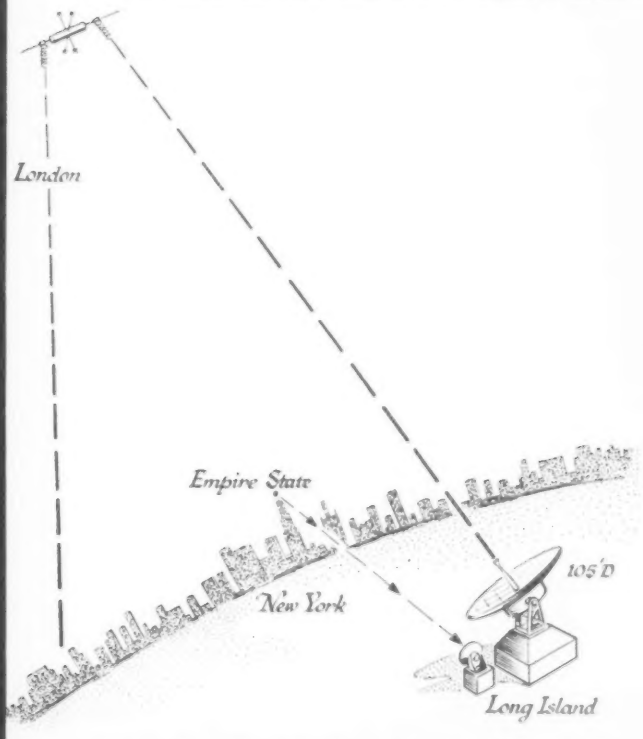


Diagram showing the respective location of the repeater satellite and its ground stations.

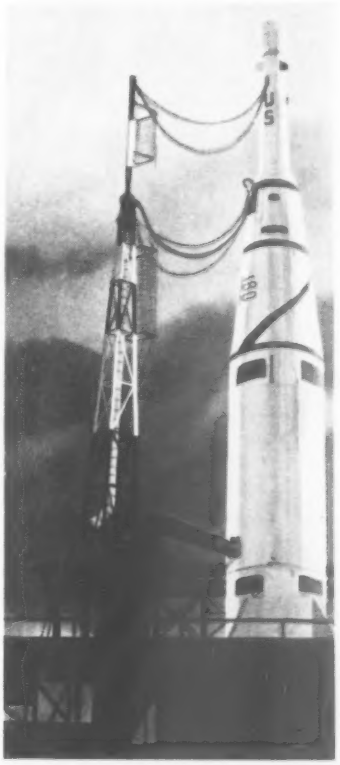
Satellite Design

Although by no means a final configuration, Space Electronics suggest that the satellite might take the form of a cylinder with two retractable helical antennæ which can be erected in orbit. The receiver would be a transistorized low-noise figure amplifier, with a band width of about 10 Mc. and an equivalent signal-to-noise ratio of 40 db., which is necessary for good TV reception. The transmitter would consist of a 40-Mc. bandwidth system using transistors with a total broadcast power of only a few watts.

This assumes the use of sophisticated modulation techniques, adequate ground antennæ and a 10-degree beamwidth transmitting antenna in the satellite. It might also depend on the presence of a maser or parametric amplifier in the ground receiving station to ensure adequate signal-to-noise ratio.

Power Supply

Solar cells would be distributed on the satellite's external surface to supply power while the vehicle remains in sunlight, a period of 22 hr. 45 min. each day. Chemical batteries, re-charged by the solar cells, would serve during the brief period when the satellite was in darkness. The latter, having an output of about 10 watts for a day or more, would be used for positioning and coarse attitude control, while the solar-cells supply the one to five watts of power required for the transmitter and the continuous operation of the attitude control system. Reaction controls for orientation purposes using, in the main, tiny control jets, would be relied upon to operate for at least a year.



Artist's impression of the Thor-Delta vehicle which will be used early next year to launch "passive" communication satellites.

The use of high gain helical antennæ requires reasonably precise control of the satellite's attitude with respect to the ground stations. To enable the satellite to align itself automatically within a few degrees of the desired attitude, three pairs of telescoping antennæ are suggested, each paid being mounted at right angles to the other two. These would be used to measure the satellite's attitude with respect to the polarized waves transmitted from the ground. Roll control would then be obtained by stabilizing to the polarization of the signals.

Multiple Channels

Space Electronics Corporation suggest that a repeater satellite of this kind could provide 250 voice channels, or 125 voice channels plus a 5-Mc. TV channel. Cost estimates of between £9 million and £14 million include developing the satellite,

purchase of launching vehicles, building of two ground stations, and making the necessary experimental launchings. The annual cost of replacing a satellite on the basis of two attempts would be about £2 million. These figures seem rather optimistic, but, of course, they assume the use of a large number of existing facilities.

A great deal of preliminary experience would also be derived from the Courier satellite and other relevant military projects.

Another recent estimate on the basis of a global system of 24-hr. orbit satellites, made by the International Telephone and Telegraph Laboratories, suggests that the cost of establishing a repeater satellite in the prescribed 22,300-mile orbit—assuming four attempts—would be about £7 million. The really interesting information, however, is that according to this company, a global satellite system operating 48 channels would cost about £240 per channel per mile, while a 500-channel system would cost only about £20 per channel/mile. Somewhere between these figures lies the cost of the submarine cable.

A further point is that existing transatlantic cables are expected to reach their capacity in the 1960s. If artificial satellites can be made sufficiently reliable and long-lasting, future expansion of communication services may take place in space rather than under the sea. K.W.G.

No Russian Space-Men?

SPEAKING before the American Rocket Society on November 16, Professor A. Blagonravov, of the U.S.S.R. Academy of Sciences, denied that Russia had a specific programme for putting a man into space. At present, he said, Russia did not see any need for manned space-flight.

Russia would put a man into space when there was a scientific test that could not be performed automatically, said Prof. Blagonravov. At present, automatic devices were capable of performing all the tasks that Soviet scientists had set up. Russia's only programme relating to the subject, he continued, was to investigate the safety of space-flight.

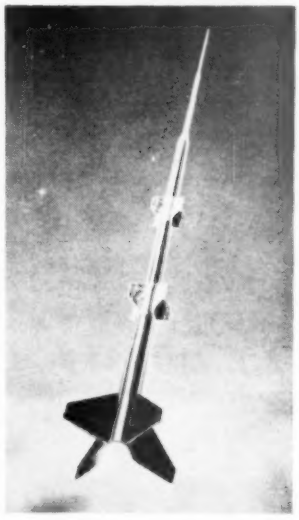
In support of this argument, the speaker showed a film depicting dogs, rats and mice being launched to altitudes as great as 270 miles in Russian rockets. The dogs were strapped down in their pressure chambers and were little affected by weightlessness, but the rats and mice, which travelled untethered, floated and twisted violently under zero-*g*. Prof. Blagonravov said that after eight minutes the rats and mice showed signs of adapting to the weightless condition.

If anything at all can be read into the Professor's remarks about men, it is probably that Russia has no interest in intermediate developments such as the non-lifting re-entry capsule, but will concentrate on the problems of a winged satellite vehicle having some independent control. We shall have to wait and see.

Six-stage Solid Rocket

A RESEARCH programme using six-stage rockets to study basic phenomena of re-entry physics is being jointly conducted by the National Aeronautics and Space Administration and the Advanced Research Projects Agency at NASA's Space Flight Station, Wallops Island, Virginia. The six-stage vehicle firings are part of a broad study of the physical conditions which occur when a body re-enters the atmosphere.

The first three stages carry the vehicle to a peak altitude of about 200 miles. After a coasting period the vehicle is propelled earthward at speeds up to Mach 22 (about 16,000 m.p.h.).



Above, a pre-firing check being made of the five-stage U.S. Army "Strongarm" research rocket. It was "Strongarm"—an artist's impression of which is on the right—which launched a nose-cone of instruments 1,050 miles into space from Wallops Island, Virginia, on November 10. The object of the experiment was to measure electron densities between altitudes of 500 and 875 miles, which, according to the U.S. Army, is the environment in which ICBMs and anti-ICBMs will operate.

Honest John, the Nike-Ajax booster, and Lance comprise the initial stages of the vehicle. A single airframe houses the last stages—Thiokol T-40 and T-55 rocket motors, and a spherical rocket motor. The spherical motor, 5 in. in diameter, was designed, developed and built at NASA's Langley Research Centre.

On test, the hypersonic speeds developed on the downward leg of the trajectory have given the nose-cone the appearance of an incandescent meteor. Before the final stage is consumed by atmospheric friction, scientists have been able to obtain considerable tracking data from optical devices, radar and telemetry.

Tracking is conducted optically at Wallops, Coquina Beach, North Carolina, and a NASA aircraft cruising in the re-entry area about 50 miles from the launching site. Radar tracking is conducted by the Lincoln Laboratory at Millstone Hill, Massachusetts, and at Wallops. Doppler telemetry receivers are at Wallops; Langley Field, Virginia; Cape Hatteras and Edenton, North Carolina.

Use of six stages in this re-entry programme is the first

(*Continued on page 545*)

LOOKING AHEAD.—Concepts based on the 1.5 million lb. thrust rocket engine, being studied by NASA, include vehicles for a Mars mission. A hypothetical four-stage vehicle designed to carry eight men on a round trip between Earth and Mars (left) is contrasted with a "cargo booster" needed for its construction in orbit around the Earth. Designed only to operate in "gravity free" space between terminal orbits around the two planets, and not to land, the vehicle would require six or more supply rockets to complete its assembly.

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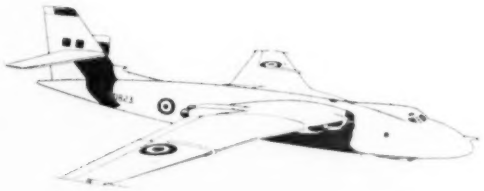

No. 4 in a series of paintings by Keith Shackleton S.Av.A. presented by Cellon Limited

Flamingos

Its rakish shape and colour makes the Flamingo unmistakable. A gregarious bird, it breeds in Southern Europe, in Spain and Mediterranean France, and southwards into Africa where colonies are found thousands strong. In Britain it is a rare visitor, but one which is obvious enough never to be missed when it comes.

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(*Continued from page 544*)

occasion on which this number of stages has been launched in U.S. research programmes. A number of five-stage rockets have, however, previously been fired to study aerodynamic heating and ballistic missile re-entry problems.

The research station on Wallops Island was established in 1945 to obtain data from free-flight models launched at transonic and low supersonic speeds by solid rocket boosters. It is now used almost exclusively in the study of hypersonic and space-flight problems. More than 3,000 test models have been fired at Wallops over the past 14 years, and, currently, more than 100 multi-stage research rockets are launched every year.

American Moon-probe

AS we went to press, final preparations were being made at Cape Canaveral to launch another Moon-probe, this time using the newly developed Atlas-Able. This was to be a repeat experiment of the firing originally scheduled during the four-day period October 3 to 6, which was forestalled because of an explosion of the Atlas-C primary stage during a static test on September 24. Fortunately, the 375-lb. probe was not in place when the mishap occurred, which is attributed to a break above the propellent cut-off valve allowing fuel or oxygen to leak.

Primary object of the new American attempt was to obtain pictures of the far side of the Moon, and presumably to add a few American names to the surface features. To achieve this, the probe was expected to be put into orbit around the Moon with the assistance of a retro-rocket.

Embodied in the Atlas-Able probe, which is spin-stabilized, is an elementary television device which depends on a photo-sensor mounted in the side of the vehicle. Designed to "see" only a small spot of light in a particular direction, the system is focused by lenses and mirrors. Thus, vehicle spin provides line scanning and the probe's motion along its trajectory provides frame scanning, graduations in light intensity building up the picture. This compares with the method used by the Russians of "aiming" the probe by means of photo-cells to line up a conventional camera squarely with the Moon's surface, processing the film automatically, and scanning the illuminated negative.

The American system is not expected to produce such well-defined pictures as Lunik III obtained but, nevertheless, the technique is capable of further development. The intention is that the pictures will be tape-stored within the probe and relayed to Earth on command.

In addition to the optical experiment, the probe is instrumented to investigate the properties of cis-lunar space, and it has been reported that an attempt will also be made to determine the Moon's mass. Needless to say, the Jodrell Bank radio telescope is again expected to play a leading tracking and communications rôle.

The Americans have already made three unsuccessful attempts to orbit the Moon—in August, 1958, when the USAF Thor-Able exploded after 77 sec. of flight; in October, 1958, when the probe reached a maximum distance of 70,700 miles and returned to Earth because of insufficient speed; and in November, 1958, when the probe only travelled 963 miles due to third-stage failure. In each case, the probe carried an electronic scanner.

Air Survey Surveyed

ADVANCES in air survey with particular reference to newly developed territories were discussed on November 19 by Mr. W. P. Smith, M.B.E., B.A., F.R.I.C.S. in the fifteenth British Commonwealth Lecture which he read before the Royal Aeronautical Society.

Few people can be better qualified than Mr. Smith to cover this subject. A director of Fairey Air Surveys, Ltd., he has been engaged on work of this nature since the War, during which he commanded survey units of the Royal Engineers. In 1945 he transferred to the survey branch of the Control Commission for Germany as a staff officer. He left the army in 1946 and joined the newly formed Directorate of Colonial Surveys as senior surveyor and went to West Africa on the Volta River project.

After conducting surveys in Nyasaland, Kenya and Rhodesia, he joined Fairey Air Surveys, Ltd. (then The Air Survey Co., Ltd.), in November, 1950, as general manager. He was appointed director and general manager of the company's Rhodesian subsidiary in 1951 and chief surveyor for the main company in 1954. He has been a director of Fairey Air Surveys since 1957.

Mr. Smith opened his lecture by saying that the failure of development projects in remote areas could often be traced either directly or indirectly to the absence of adequate maps. There was no excuse for this today, because of the relative ease with which maps could be produced following aerial surveys.

He went on to discuss the advances in camera equipment since 1946 when the U.S. K.17 camera came into R.A.F. use. The biggest advance, and one which represented a considerable leap forward, was the introduction of the Swiss Aviogon optical unit used with the R.C.5a camera.

This had greatly improved the pictorial quality of the work produced and gave excellent reproduction of detail. It made possible photography from greater heights with consequent reduction in flying distance necessary to map a given area. For example, to cover an area of 40,000 sq. miles when photographing at 20,000 ft. a distance of 10,000 miles must be flown. The same area when photographed from 40,000 ft. demanded a flying distance of only 4,650 miles. The scales of the prints produced by photography at 20,000 and 40,000 ft. were 1 : 40,000 and 1 : 80,000 respectively. Current practice was to produce photographs to 1 : 40,000 scale.

Another advantage of this camera was that photographs could be taken in poorer light conditions than in the past. For example, in regions where cloud cover built up during the day survey flights could now be made early in the morning before the ground was obscured.

Other technical advances had been made in film, which was subject to distortion in the tropics. The latest plastic-based film was relatively distortion-free. The introduction of electronic printing had improved the quality of prints by varying the intensity of lighting during exposure according to negative density. This gave better reproduction of detail in dark areas.

Discussing survey aircraft and navigational techniques, Mr. Smith said that there had been little advance since the War. Typical aircraft used were the B-17, Dakota, Mosquito and Survey Prince. Keeping the older aircraft serviceable was increasingly difficult.

There was a need for an aircraft with a 30,000-ft. ceiling, a payload of 1,700-5,000 lb. and a range of up to 2,000 miles. Although current aircraft such as the Friendship or Dart Herald would be suitable, their first cost was too high to make their use economic for commercial surveys

Mosaics

Mr. Smith went on to discuss the importance of aerial photography in the study of geology, agriculture and forestry in newly developed regions. He emphasized the importance of photographic mosaics, which could be produced in a few weeks after survey flights; actual maps took months or even years.

As an example he showed a mosaic of Barbados which had been produced in 10 weeks. He also mentioned work in British Borneo, where geological study by ground parties had been preceded by an intensive study of mosaics; this had shown the best regions for ground work.

An interesting example of an aerial survey map shown by Mr. Smith was one of the Kariba Dam area on the Zambezi River. A photograph compared with the map showed the dam partly full; the water level coincided exactly with the appropriate contour line on the map, which had been produced before the dam was built.

Mosaics, he said, played an important part in studying agricultural and land-tenure problems. Study of them gave information on soil-type boundaries which was invaluable in planning future developments.

Progress had been made recently in reducing the need for ground control during aerial surveys. Radar techniques such as SHORAN and HIRAN had been used successfully in Canada to give ground distances with an accuracy of 1 in 70,000; ground stations were 200 miles apart. Ground-height control was also a problem because of the greater accuracy needed.

The development of the airborne profile recorder had been a big advance in this respect; by comparing the readings of an accurate radio altimeter and a hypsometer—a sensitive pressure altimeter—it was possible to measure the ground profile relative to a constant-pressure surface at the aircraft height. During a survey in the Aden Protectorate two different observations over a town had given a height difference of only 18 ft.

Mr. Smith went on to discuss the use of aircraft for geophysical surveys and for the detection of deposits of radio-active ore and local variations in the Earth's magnetic field.

He ended his lecture by mentioning some future trends. One of the most important was the striving after increased coverage per exposure; the introduction of new "super-wide-angle" cameras would, he said, make this possible.

Large-scale Maps from Air Photography

by Molly Neale, B.Sc., D.I.C., A.F.R.Ae.S.

LESS than 10 years ago a small air survey company started operations from Redhill Aerodrome with the minimum of equipment—one aeroplane and camera, one map-plotting machine with three projectors and, most important asset, five experienced air surveyors with enterprising ideas and the ability to get the utmost from the equipment available to them. Today the company, Meridian Airmaps, Ltd., now at Shoreham Airport, Sussex, has grown sixfold, has added some of the latest precision equipment to its resources and is on the threshold of new prospects overseas.

Still a small company, Meridian has achieved a high reputation in the United Kingdom as pioneers in large-scale accurate surveys.

Four of the original five who founded the company are the key-men of Meridian today: Mr. N. E. Lamb, managing director; Mr. H. G. Gibson, director and general manager; Mr. A. P. Gillings, production manager; and Mr. H. H. Price, technical representative. Completing the administrative side are Mr. I. A. Forbes, director, and Mrs. O. M. Wadlow, director and secretary.

The company owes much to Mr. F. G. Miles for his considerable assistance and guidance in those early days and, furthermore, for supplying the Aerovan which, with a modified Perspex nose, formed an ideal photogrammetric survey aircraft in the first few years.

The aircraft operational division consists of two pilots and three aerial photographers, coupled with a photographic section of five laboratory staff concerned with the processing and general photographic duties. In the photogrammetric department there are 10 operators, and the drawing office and compilation section is made up of nine cartographers.

Of the field survey staff of eight, four surveyors are currently working overseas under sub-contract to a leading British petroleum company in Nigeria, Libya and the Argentine. To co-ordinate overseas operations, Mr. R. H. Windsor, long associated with air survey and one of Airwork's first pilots, has recently joined Meridian as overseas projects manager.

Meridian is planning its overseas activities on the basis of supplying the customer with a complete service, aiming to undertake both topographical and geophysical investigations. To this end it has recently entered into a working arrangement with Le Grand Adsco, Ltd., and Site Investigations Co., Ltd., who are member companies of Stone-Platt Industries, Ltd., together with Dr. G. L. Paver, M.B.E., consultant geologist, geophysicist and hydrologist, and principal of Geophysical Surveys (Pty.), Ltd., of Johannesburg, South Africa. These companies are specialists in drilling, geological and geophysical surveys for water supplies and minerals, and soil mechanics investigations in all parts of the World.

The company is at present operating an Auster Autocar and has more recently acquired a Consul aircraft for medium-level photography. For its work overseas, which it intends to take up in the near future, it plans to use multi-engined aircraft with greater range and altitude capabilities; a Marathon aircraft has just been undergoing C. of A. overhaul with a view to serving for geophysical aerial surveys.

MANAGERIAL CONFERENCE.—L. to R., H. G. Gibson, director and general manager, A. P. Gillings, production manager, Noel Lamb, managing and technical director, and R. H. Windsor, manager, overseas projects—of Meridian Airmaps.

Also with new overseas projects in view the company has added a fully automatic Wild R.C.8. aerial film camera to its equipment. This instrument is specially designed by the famous Swiss company of Wild Heerbrugg, Ltd., for use in small aircraft. It is equipped with a high-precision 6-in. wide-angle Aviogon lens, which is, for all practical purposes, distortion-free, and incorporates a viewfinder telescope, which is used in conjunction with a built-in overlap regulator to set the overlap automatically. The viewfinder telescope also serves as a drift sight; the film magazine is changeable in flight and takes approximately 200 9-in. by 9-in. exposures.

The company emphasizes the fact that, without the Aerovan, it could not have attained its outstanding success in large-scale surveys—an achievement that has surprised the purists in photogrammetry. Thanks to the slow-flying capabilities of the Aerovan—around 50 m.p.h.—and the fact that in the company's early days authorization could be obtained for flying at 600 ft. altitude, Meridian has been able to produce maps to a scale of 1 to 500 to an accuracy of ±6 in. in both the horizontal and vertical planes, using projection apparatus—Williamson SP3 Multiplex machines—which is normally used only for much smaller-scale surveys.

The recent acquisition of Williamson large-scale plotters, the first to be used by a commercial firm, has permitted the same degree of accuracy to be achieved at twice the flying height.

Photogrammetry is, in essence, the production of a series of overlapping photographs which, viewed subsequently in pairs, through special plotting instruments, form stereoscopic images from which both vertical and horizontal distances can be

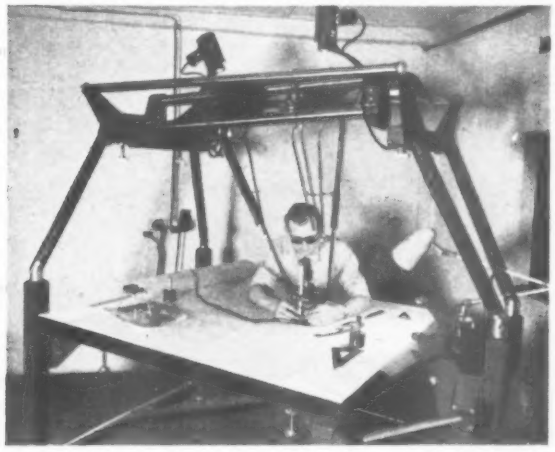
Meridian's fleet of survey aircraft. Marathon, Consul and Autocar.

scaled and contour maps can be plotted. In order to do this it is necessary to know the heights of several control points in each photograph in order to allow for any fore-and-aft "tip," or lateral "tilt," as well as to determine the scale of the photography. Although aerial survey flying calls for piloting skill of the highest order, it is beyond the capabilities of any pilot, human or automatic, to fly continuously 100% straight and level.

In Great Britain there is no great difficulty in laying down control points, since there is reasonably complete map coverage over the whole of the country and, too, communications are good. It is a very different story in under-developed territories overseas, where very lengthy and costly ground surveys may be involved to establish control points; in consequence, a higher degree of sophistication, to minimize the ground effort, is demanded of cameras and plotting instruments for use in overseas mapping projects.

Flight-planning a photogrammetric survey in the United Kingdom is carried out by Meridian with the aid of standard 1-in.-to-the-mile Ordnance Survey maps. The height at which the aircraft will be flown is determined according to the required scale of the survey; if a block area is to be covered, parallel flight lines are plotted on the map at distances such that the lateral overlap on the resulting photographs will amount to 30%. The aircraft will be flown alternately "up" and "down" the adjacent flight lines.

In flight, the photographer, in prone position, views the ground through a drift sight while following the map, and directs the pilot accordingly. The fore-and-aft overlap of successive frames is set by an intervalometer—an electrical auto-timing device—which is preset by the photographer to give an overlap usually of about 60%. Meridian, in fact, work to 57%, which is the minimum for stereo cover.

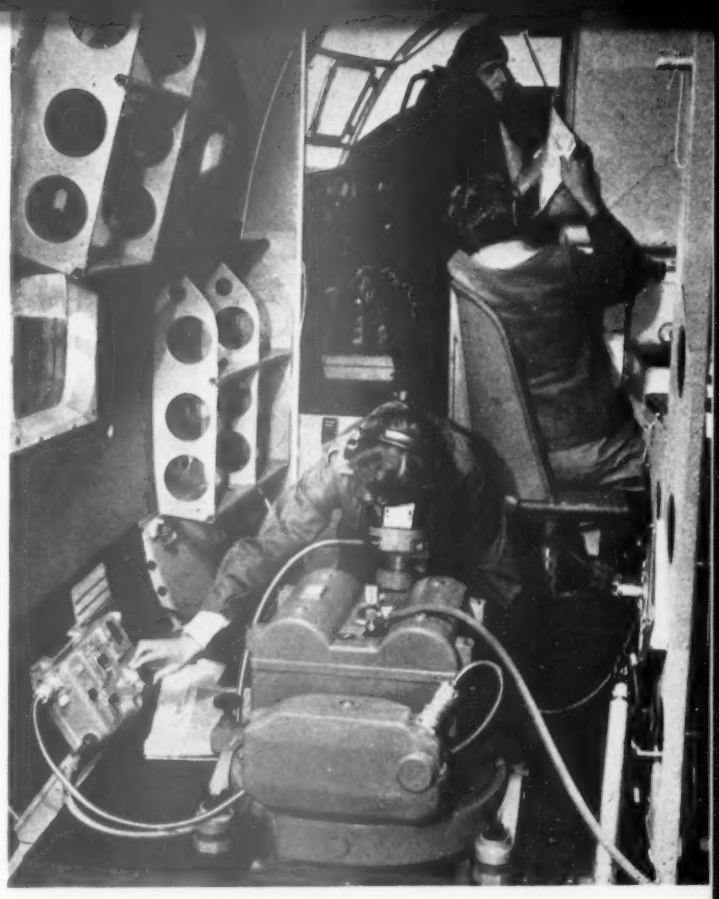


A Williamson large-scale plotting machine.

The photographer levels the camera and sets it for drift so that it is aligned along the desired flight track; then, identifying points on the ground below with the aid of the map, he switches on the camera just before entering the area to be surveyed, and thereafter camera operation is automatic. On each frame is recorded the number of the exposure, the time, the aircraft height fed from the altimeter, and the degree of level of the aircraft as indicated by a small spirit level on the camera housing.

The film used in the camera, housed in a magazine, is usually in lengths of 165 ft.-200 ft., and the area of each photograph is 9 in. by 9 in. After the survey flight has been completed and the aircraft has returned to base, the film magazine is removed and processed immediately by the photographic department. The roll film is wound into canisters, which are immersed in tanks in the darkroom; these canisters are arranged either for hand or electrically controlled development, and the process takes about 20 min. to half an hour.

After processing, the wet film is transferred to a rotary drier. Contact prints are then taken off—one set for the field survey team and another set for the customer. Quite apart from their use in map making, the survey photographs can provide valuable information in themselves; Meridian finds, however, that many clients do not make the fullest use of them. Study of the photographs can give very useful pointers for the preliminary layout of work, for example, or the routeing of electricity supply pylons.



Photograph taken in flight of an aerial survey operation. The camera is a Wild R.C.8. automatic aerial film camera. The camera operator is controlling the overlap through an optical sight in conjunction with the control box to ensure a perfect 60% forward overlap.

The contact prints supplied to the field survey team are used for establishing the essential control points, suitable points on the ground being identified on the photographs. Usually four such points to every overlap are sufficient.

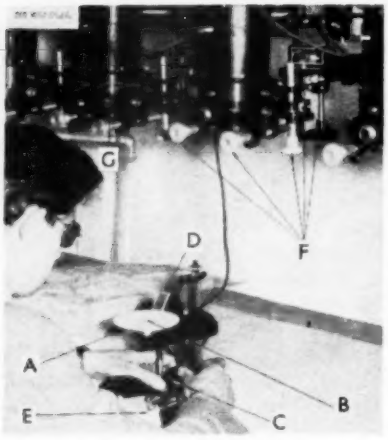
Meanwhile, at base, in the photographic department, positive slides known as "diapositives" are being produced for use in the plotting instruments. These are of two types, the Williamson SP3 Multiplex machines already mentioned, of which Meridian now have five each equipped with seven projectors, and, recently acquired, two large-scale highly accurate Williamson plotting machines. The latter take diapositives 9 in. by 9 in. obtained by contact printing direct from the film; for use with the Multiplex machines, on the other hand, reduced diapositives are required (50 mm. by 50 mm.), and these are produced in a reduction printer designed for the purpose, specially calibrated to ensure that no distortions are introduced through slight errors in the lenses of the camera, printer or projector.

The Multiplex machines each consist of seven projectors in line in which are mounted in sequence a set of diapositives representing a portion of the flight path. Two adjacent projectors are used at a time, the images being projected on to a small tracing table, one through a red glass and the other through a blue glass. The observer views the two images through blue-and-red spectacles, so that when the projectors are properly aligned and corrected for tip and tilt by means of the known control point data a stereoscopic image is obtained on the table.

In the centre of the table, which is adjustable over a calibrated scale, is an illuminated pinhole. Aligned vertically below this is the tracing pencil with which the map points are plotted on a stable transparent plastic sheet mounted on a machined-steel plotting base.

The Multiplex machines give a final magnification of 2½ times and have been completely satisfactory for producing maps with scales as large as 1 in 480. In comparison with the newer large-scale plotters, they have the advantage where strip photography, such as is used for planning roads and railways, is concerned. For covering large areas, however, the large-scale Williamson plotters, which project much more light and produce a better image with a final magnification of five times, are more convenient and economical to use.

Basically similar in principle to the Multiplex, the



USING THE MULTIPLEX.—In this plotting machine 2-in. square diapositives (located at G) are projected through red and blue filters. The operator, wearing red and blue glasses, adjusts the light-point B, by turning C until B appears on the ground on the stereoscopic image on A. Ground height above sea-level, accurate to ± 6 in., is read off D. The map is drawn by moving B over the ground on A while pencil E records the trace on Astrofoil sheet below. F are adjustments.

Williamson large-scale plotter has two overhead projectors, each mechanically linked to the tracing table, which is of the same type as that used on the Multiplex machine. By this means it is possible to concentrate the projector lamp illumination on the small area of the diapositive that is actually under observation on the tracing table.

Tip, tilt and swing controls for the projectors are attached to the tracing table. The plotting table, on which the transparent sheet is carried, is a 2½-in. ground-slate slab with an overall flatness of 0.001 in.

The machine plot—completed so far as is possible from the photographs—is then passed to the drawing office to be "fair drawn." These "fair drawings" are produced to set standards, using also standard letterpress pre-printed on transparent adhesive strip film. From the final drawing, a master copy is made by a lithographic process and from this can be taken off prints as required.

Some of the projects undertaken by Meridian Airmaps include the mapping of 36 air bases in Great Britain for the U.S. 3rd Air Force to a scale of 1 to 2,500, together with photographic reductions and enlargements to various scales.

For British Railways—Southern Region—the company has undertaken since 1955 approximately 400 miles of 1/1,250 survey and 1,500 acres of stations at 1/480 scale for the modernization programme, which entails electrification of the railway system.

As already mentioned, Meridian has figured prominently in the road-development programme and has carried out a considerable number of schemes at scales of 1/360 and 1/500. Among these are the A2 trunk road from Woolwich to Rochester, for the Kent County Council, 20 miles of 1/500 and also 1/2,500 surveys for the same area, and for the Saltash Urban District Council surveys were undertaken to a 1/360 scale forming the Devon and Cornwall link across the River Tamar.

A rather interesting project was undertaken for the South of Scotland Electricity Board in respect of the siting of the Hunterston power station in Ayrshire. This site was surveyed at a scale of 1/500 without the surveyors entering the area for ground control. This was necessary because of the stipulations placed on this project by the electricity authorities. Therefore, having no access to the area, control was laid down on the roads surrounding the proposed site. This information was sent back to Shoreham, where the survey was then plotted and produced according to the client's specification.

For the National Coal Board, considerable surveys have been undertaken, at scales of 1/500 and 1/1,250, of collieries for various Area Boards in South Wales and the Midlands. Work has also been done for the Ministry of Transport, Sheffield Corporation, Manchester Corporation, Central Electricity Generating Board and various other local authorities.

Recent awards are: Staffordshire County Council, 27 miles of 1/500 and 1/1,250 for road-development schemes; and for British Transport Commission, a survey is to be made of the old and new Southampton docks, totalling approximately 450 acres.

News of Industry

Air-cooled Brakes

ONE of the new developments for aircraft shown for the first time at Farnborough this year was the Dunlop air-cooled brake. Manufactured by the company's Aviation Division, it is primarily designed to provide a means of speeding up the turn-round times of aircraft by rapid cooling of the wheel brakes.

Consisting of a built-in fan driven by a fractional h.p. electric motor, located in the axle, the cooling unit draws air through the wheel, causing forced ventilation.

Since the S.B.A.C. show the Division has produced a booklet on the air-cooled brake, which includes extracts from test reports on the unit. From these tests, undertaken in the laboratory using its large dynamometer, Dunlop have reproduced a number of interesting results.

These include the reduction of maximum tyre bead temperature due to "soak-through" from the wheel heat sink from 155° C. to 55° C.; and the reduction of the maximum hydraulic fluid temperatures from 178° C. to 65° C.

The report also stated that after a normal energy stop without the fan running the maximum brake temperature was 650° C. cooling to 200° C. in 68 min. With the fan running, a similar energy stop gave a maximum brake temperature of 620° C. cooling to 200° C. in 14 min. The hydraulic fluid in the brake after a full energy stop rose to a maximum of 133° C. after 23 min. without the fan running, compared with 54° C. after 9 min. with fan running.

After a simulated take-off, flight and landing with appropriate taxiing the cooling time for the brake, without the fan, was 100 min. from 700° C. down to 200° C. With the fan running the time was reduced to 13 min. and the maximum temperature was 600° C. (200° C. is considered the maximum temperature at which take-off should be undertaken).

Measuring and Machining

A PRIVATE demonstration of precision measuring instruments and machine tools was recently held in London by Taylor, Taylor and Hobson, Ltd., of Leicester. One of a series that the company has held in various parts of the country, it included a number of instruments used by the aircraft industry.

Among the items on display was the Micro alignment telescope designed for precision alignment and checking of parallelism, squareness, plane and horizontal surfaces. Employed in the setting-up of aircraft jigs and the building and inspection of machine tools, it has an accuracy within ± .001 in. at 50 ft. With the addition of a telescope lamphouse, auto-collimation, auto-reflection and alignment-projection, readings can be obtained over distances up to at least 60 ft.

A development of the basic telescope for checking such items as the alignment of the adjustable foot pads of aircraft and engine jigs, is the sweep optical square. Used in conjunction with four "targets," a working reference plane can be established accurate to within 1 sec. of arc in angle, plus .0005 in. in displacement.

This reference plane is set up in the correct relation to the work by adjusting the two levelling feet of the sweep optical square until the micrometer readings are equal on three datum targets. The micrometer datum drum is then set to zero and locked. The fourth target is then placed at each check point (an adjustable foot pad for example), the prism box rotated on to it, and the micrometer reading taken. This reading is a direct measure of the flatness errors with respect to the reference plane set up through the three datum targets.

Another aircraft instrument on display was the Talyrond. Employed in measuring errors of roundness, it carries an electric pick-up at the lower end of a spindle having an error of roundness not exceeding .000003 in. A stylus arm engages the specimen and radial errors of shape are converted into an electrical signal which is amplified and fed to a polar recorder. Two models of the Talyrond—50 and 2—are produced by the company for accommodating components of different sizes.

Taylor, Taylor and Hobson also produce a blade-edge microscope for the critical viewing of leading and trailing edges of turbine blades. With a magnification of x40, rendering errors of .001 in. visible, this microscope is being developed for aircraft model work. For this, the diameter of the field of view is enlarged to ¼ in., and a micrometer means of measuring is fitted to the present instrument.

Personal Flying

Max Conrad, the well-known American transatlantic light-aeroplane pilot, was recently awarded a trophy as "Pilot of the Year," by the National Pilots' Association of the U.S. The award was presented in recognition of the pioneering done by Max Conrad in establishing routine transoceanic operations with light single- and twin-engined aircraft, and especially for his recent record flight in a Piper Comanche.

This was non-stop from Casablanca to Los Angeles, a distance of 7,683 miles, in 58 hr. 40 min., using only 6¾ gal. of fuel per hour. On take-off from Casablanca, the Comanche grossed 5,000 lb., compared with its normal 3,800 lb., and it landed with sufficient fuel for a further five hours.

The Comanche, N110LF, has since had its 250 b.h.p. Lycoming replaced by the smaller 180 b.h.p. engine, and Max Conrad disclosed that he is to attempt to beat the late Bill Odom's 1949 record Bonanza flight from Honolulu to Oakland, in the near future.

• • •

Latest figures on Canadian personal flying indicate a continued growth up to the end of 1958. By then, 9,453 private pilots' licences were current, compared with 7,832 at the close of 1957. Private pilots outnumber their commercial brethren in Canada by about 3 : 1.

• • •

Like words from another world came these extracts from a recent speech by Gen. Quesada, Administrator of the U.S. Federal Aviation Agency, to the Society of Experimental Test Pilots. "Most of us," he told these veterans, "can remember the open cockpits, the scarf and goggles, oil on the windshield. . . ."

If the General cares to come to this country, he can recapture this nostalgic feeling at any of our flying clubs, alongside our newest student pilots. In some of his other remarks, however, is epitomized the brave new world of personal flying across the Atlantic, and the kernel of his theme on "a Pilot's Philosophy for the Space Age."

LIGHTWEIGHT AUTOMATION.—Single-axis autopilots are widely fitted to U.S. light aircraft, but the Sperry Phœnix Company has developed a lightweight three-axis type. Seen here in a Cessna Skylane, it offers heading, altitude and glide path coupling facilities and weighs from 11-27½ lb.

"In the field of private flying, we find the true pilot, whether he be the Sunday flier who flies for the sheer fun of it, or the businessman who flies to increase his productivity. He represents the backbone of our aeronautical growth. He is the non-professional. He believes so strongly in flying that he pays for his own plane and buys his own instruction. In him lies the most explosive area of our aeronautical future. But he, too, must accept new responsibilities. He, too, must become more safety conscious. We have *over 67,000* [our italics] U.S. registered single-engine planes. We are now producing over 8,000 general aviation aircraft per year. Each one of them will require conscientious and well-trained pilots, if these new machines are to be properly utilized."

This should be required reading for the Minister of Aviation.

Wroaming Around the Antipodes by Herald

With the exception of pubs and the essential services, New Zealand dies over the week-end. One of the Dart Herald crew asked, on a Friday, if he could get some laundry washed and returned by the next day. "Sorry, we don't work Saturdays" he was told, "you'll have to have it tonight."

And so we left New Zealand, where friendship is loyally British, except that part of it which is Dutch—and even that is 36 per cent. British. At Whenuapai, Auckland's airport, our Heraldic crew had to wait for a weather forecast for the 630 miles Tasman crossing to Norfolk Island, a route which has few ships and aircraft to supply "actuals." Eventually, Alan Johnson, a seconded B.O.A.C captain who partners "Hazel" for most of the flying, came out of the met. office brandishing a sheaf of papers and reassured us with "There you are, chaps—six pages of 'Nil'."

FARNBOROUGH AT WELLINGTON

(A familiar situation, this time on the Bristol Aeroplane N.Z. Co's stand at the Wellington Airport Display. On the receiving end are Air Cdre. GEORGE CARTER, Managing Director (Centre) and B.J. CORNTHWAITE, Sec. & Tech. Rep.)

Nevertheless, all the indications were for a favourable voyage and so it turned out. At eighteen thousand we looked down on unbroken cloud for the first 100 miles or so, then flew over a stretch of lenticular clouds which I thought were caused only by mountains or hills. I must ask "Doc" Slater, this journal's gliding and weather expert, when I get back. The five-miles-by-three island came up dead ahead and we circled its lovely, rugged coast before flying over the Customs Officer's house to let him know that duty, preferably with a small "d," called.

After lunch, a swim in the island's coral-sheltered lagoon, when "Hazel" very nobly salvaged an outboard motor after it had fallen off a boat which "buzzed" him. Then a pleasant evening with everybody wreminiscing for Wroundabout. Alan recalled a squadron commander's succinct comment written on an accident report: "An act of God," and the group captain's succincter note: "I see no evidence of Divine intervention." Then, on aircraft warning devices, which can irritate by malfunctioning as much as they warn, the case of the pilot who, when asked what that "little red light" meant, replied "It means that some fool has put the bulb back."

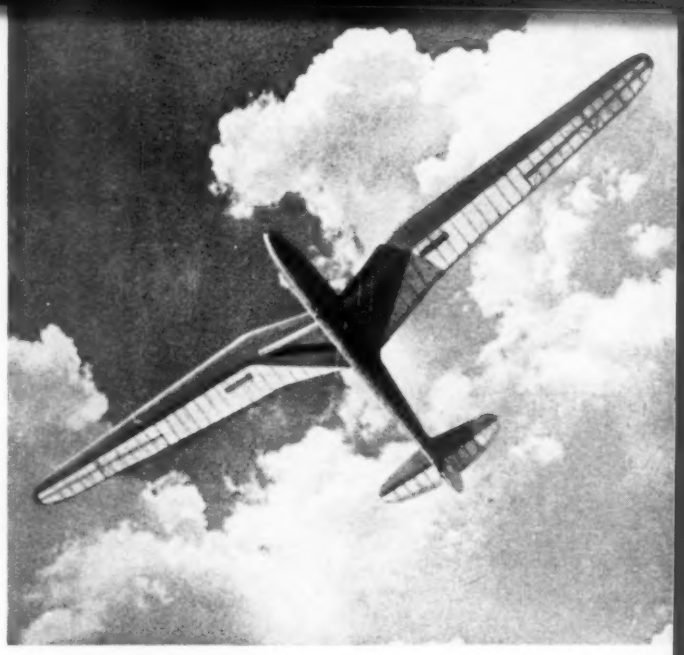
On, on—Brisbane, Sydney, Canberra, Melbourne—unloading, demonstrating, loading, hotels, people—especially people. At one place, a crewman's wry remark: "I see 48 of our 36 passengers have turned up."

John Watkins, T.A.A.'s Director of Engineering, flew to the Rongotai display in one of his line's Friendships, chartered by Fokker's for the occasion. In a Press interview he spoke well of the Friendship not surprisingly, and in consequence was regarded by the Herald supporters as Fokker's secret weapon. Be that as it may, I have, in Melbourne, just seen him *buy* a Herald. Not, alas the splendid Woodley Wonder, the *Melbourne Herald*.

by Wroam

Gliding Notes

by Dr. A. E. Slater



A Canadian-built two-seater Harbinger, designed by W. Czerwinski and B. S. Shenstone. The only other one in the World is based on Camphill in England.

HAILSTONES from a summer thunderstorm did extensive damage to a Tutor of the Taunton Vale Gliding Club, which operates at Dunkeswell, near Exeter. But when a cu-nim passed over on Sunday, October 25, the club got its revenge, for Mr. Fleming, the chief instructor, tackled the storm and got up to 11,000 ft.

Presumably this was not in the same machine, although it was good Tutor weather in the West, for the Dublin Gliding Club's Tutor was taken up for Silver "C" height the same day by John Kerney, though without a barograph. He climbed from an 800-ft. launch to cloud base at 5,000 ft., finding it to be concave, as the horizon was blotted out all round except for one narrow escape route which he took.

From Lasham on the same day, Ron Willbie flew 35 miles and Frank Cadwallader, a Crown Agents' Club member from Tanganyika, soared for his "C" in a late afternoon "blue" thermal.

The unstable air which facilitated these mid-autumn flights appears to have had its source in the Canadian Arctic five days before. It followed a cold front which passed over Taunton Vale at 18.00 hr. the previous evening.

* * *

IN South Africa national speed records for the 100-km. triangle have been set up. First, Tim Boat-Biggs made 81.08 km.p.h. (50.38 m.p.h.) in an Air-100 on September 20, and then E. "Boet" Dommisse capped this with 90.6 km.p.h. (56.3 m.p.h.) in his newly arrived Skylark.

The international record for the 100-km. triangle was beaten twice this year by Dick Schreder in the United States, first with 98 km.p.h. on August 6 and then 105 km.p.h. on August 11. Dommisse thought at first he had come near this with at least 95 km.p.h., but the distance on his map exceeded the official "trigonometrical survey" distance by 6 km. or more, and he wonders how much of the excess is due to the "F.A.I. radius of the Earth" being less than the radius at his latitude, and also to his being high up.

If you fly round the World at 2 miles a.s.l., you will have travelled 12.6 miles farther than its circumference at sea level; but 100 km. is only one 400th part of this. And the Earth's radius at the equator exceeds its mean radius by nearly 7 miles, giving an error of about one-tenth of a mile over 100 km. at the equator.

* * *

SEVERAL international records set up in Poland have now been homologated by the F.A.I.:—

Two-seater goal-and-return, 303.5 miles by Kirakowsky and Wisniniewski on May 12, beating a similar record of 278 miles set up earlier the same day.

Women's single-seater goal-and-return, 228.7 miles by Pelagia Majewska on June 20; and two-seater 300-km. triangle, 38.35 m.p.h. by Lucyna Bajewska and Janina Tomala on May 9.

The gain-of-height record set up in a cu-nim by K. Bauer in Germany on June 20 is officially 31,709 ft., and beats by 1,609 ft. the record set up by W. S. Ivans in the Bishop Wave in California in 1950.

The single-seater triangle records are all held now by Dick Schreder in the U.S.A., and are officially: 100 km. at 105 km.p.h., 200 km. at 108 km.p.h., and 300 km. at 95 km.p.h. (65.2, 67.1 and 59.0 m.p.h. respectively).

* * *

The venue of next year's World Championships is now announced as Keulen airfield, near Cologne.

* * *

AT the Midland Gliding Club, according to the November issue of its magazine *Wingtips*, 1,759 hours were flown this year up to the middle of August. This figure includes 555 hours in a single month—June. Cross-country flights from the Long Mynd totalled 1,052 miles in the 3½ months ending mid-August, and these included the first flight from east to west across Wales, made by Randall in a Skylark 2 with a landing at Towyn, on the coast north of Aberdovey.

Since blind flying cannot be practised in clouds with an intermittent airway nearly overhead, the club Eagle has been fitted by Mike Randle with curtains round the rear seat.

The Club Christmas party is on December 20.

* * *

SOARING in the Helm Wind Wave, which can form in north-easterly winds in the lee of Cross Fell in the northern Pennines, has only been done once in a sailplane, on June 26, 1939. On that day the late Noel McClean caught the "rotor" lift in a Grunau at only 600 ft. above the valley floor and, after passing through a turbulent zone into the main wave, climbed 11,140 ft. to a British height record.

But nobody knows when to expect the Helm Wind, and these are inhospitable parts for glider pilots to camp out, perhaps for months on end, waiting for the wave. The only practicable way to catch it is to lay on a scheme for transporting a glider there which can be put into action at a moment's notice. The Newcastle Club tried to do so just after the War; Richard Prestwich had it organized two years ago; and the Cambridge Club made an expedition about a year ago.

Now Gp. Capt. N. W. Kearon, having been posted to R.A.F. Carlisle, is taking the opportunity to organize an expedition on behalf of the R.A.F. Gliding and Soaring Association, and hopes eventually to be in a position to tow a sailplane into the Helm Wave as soon as it appears. Possible sailplanes are a Skylark 3b, Eagle and/or Olympia. Furthermore, a group from the Cambridge Club intends to have another go, and the Yorkshire Gliding Club has begun to organize a scheme; both have permission to use the R.A.F. Station at Crosby-on-Eden.

* * *

MEANWHILE the Yorkshire Club has been exploiting the west face of the Hambledon Hills, which stretches 12 miles northwards from the club site at Sutton Bank. It looks good on the map but is actually very irregular; nevertheless, four club machines soared along it and back on Oct. 25, all in slope lift. D. S. Rennison in a Kite 2 made longest distance to Ingleby Cross and back, and J. K. White ran him close in the Skylark 1.

The south slope produced an excellent lee wave on Sept. 22 in a north-west wind, in which Keith Moorey climbed to 7,200 ft. in his Kite 2, while Chris Riddell wandered five miles out over the Plain of York in his Skylark 1. They had the usual experience of being forced down by darkness just as the wave was improving.

At the Club's Annual General Meeting on Oct. 31, F. N. Slingsby was re-elected president and J. C. Reussner chairman. The membership has risen to 137, including 107 flying members, and there are six club machines for them to fly, with one in reserve. The most notable announcement was that the Club is well on the way to buying its site at Sutton Bank, after being there 25 years. The Ecclesiastical Commissioners are presumably still the owners, and in the original lease they made it a condition that there should be no flying on Good Friday morning.

* * *

LONDON GLIDING CLUB had already reached an annual record of 2,757 hours up to the end of September only. In August 612 hours were flown. As a send-off for the new year, and to do even better, flying will be laid on at Dunstable every weekday from January 4 to 8 inclusive if enough members promise to come.

Correspondence

B.O.A.C. and Capacity Ton-Miles

IN connection with the letter from Mr. R. E. Mills ("Those Invidious Comparisons," Nov. 6), it is no secret that the man-hours on comparable jobs in the Engineering Department have been, and still are, higher in B.O.A.C. than in many of its competitors. B.O.A.C. has not attempted to hide that fact, and has gone to some lengths to explain the steps that are being taken to correct the situation. An extensive reorganization in the Engineering Department is in progress. Considerable improvement has already been achieved and there is still greater improvement to come. But in all other departments it is categorically denied that there is serious over-staffing in B.O.A.C., or that B.O.A.C. does not compare favourably with its major competitors in this respect.

In 1957, B.O.A.C.'s C.T.M.s per employee were 16,650. In 1958, the figure was 19,110—an improvement of 14.8%. In the same period other major operators showed the following percentage improvement:—

Air France ...	5.1%	SABENA ...	7.2%
B.E.A. ...	6.0%	S.A.S. ...	−3.2%
K.L.M. ...	9.3%	T.C.A. ...	7.6%
P.A.A. ...	0.5%	T.W.A. ...	7.2%

In this period, therefore, B.O.A.C. improved noticeably faster than any of the other airlines mentioned and it is of interest that B.O.A.C.'s figure of C.T.M.s per employee is now higher than that of K.L.M., B.E.A. and SABENA.

To attempt to correlate numbers of employees with passengers carried or with route miles is utterly misleading. As the Editor himself points out, like is not being compared with like. We would also deny that the comparison is any more valid between B.O.A.C. and Pan American than between any of the other airlines quoted. Among other things, Pan American have a large number of short-haul passengers on the San Juan route which alone would invalidate a comparison on a basis of number of passengers carried.

F. C. GILLMAN,
Chief Press and Information Officer, B.O.A.C.

London, W.1.

In Praise of the Tiger

IN reply to your remarks under "Personal Flying" concerning the Tiger Moth and further to Mr. Brown's letter, may I add a few words.

Mr. Brown spoke very fairly and is obviously a man who will not ridicule an old and faithful servant and obviously has had some experience with these remarkable little aeroplanes. Your remarks can only be referred to as childish and unimaginative. What one type of your ultra-modern "tin" aeroplanes possesses the versatility of the Tiger? In every form of flying can this little marvel be found even to this day. Banner-towing, glider-towing, trainer, racing, aerobatics, crop-spraying, photography, taxi, touring, even inverted flying, just to mention a few of its accomplishments.

After 26 years' service, this little fellow is still being produced and, indeed, is the very backbone of business at Croydon Airport by a well-known firm. Several Continental countries still buy this useful little machine in spite of the large number of American light aircraft appearing on the scene.

Among the reasons for the Tiger's survival are its enormous strength, comparatively cheap costs of repair, cheap and easy maintenance and equipment with one of the world's most reliable engines. These points are important from a club's point of view and even that of a private owner. An illustration: through a taxi-ing mishap, a Tiger Moth and Chipmunk sustained precisely the same damage to propeller and port wing spar and leading edge. The Tiger was back in service after 1½ days, the Chipmunk after 15 days. Forgetting even the loss of revenue through being off service, the cost of labour and materials of the Tiger was only 8% of that of the Chipmunk. "Tin" aeroplanes are undoubtedly more difficult and expensive to repair and maintain than wood, fabric and tube steel.

Radio was mentioned, so may I hasten to add that a number of Tigers have been so equipped, indeed, their record for serviceability is higher than the average "tin" aeroplane.

Concerning aerobatics—have you never heard of the Lockheed Aerobatic Trophy contests held at Coventry each year? Over the past few years the main British contestant has been one, or even two, as this year, "Tiger Moths." Have you never heard of G-APDZ and G-ANZZ? Have you never heard of the Tiger Club, the only flying circus in this country, who indulge in racing and aerobatics, and equipped chiefly with Tigers for this very purpose? Have you never heard of Leon Biancotto, one of the world's ace aerobatic pilots, who insisted on tackling the 1959 Lockheed Trophy in a Tiger? This man is an artist and no fool. To quote his own words:

> "A wonderful little aeroplane, the possibilities of a Tiger have yet to be fully explored and she is quite capable of winning this Trophy one year."

Yes, this remarkable machine is still capable of "mixing it" with your modern expensive "tin" aeroplanes, indeed, she is the only British aircraft to reach the finals.

Regarding the luxuries of enclosure, have you never heard of the Rollason Taxi Tiger, or the Thruxton Jackaroo? Further, there are some people who prefer the open cockpit, just as some prefer motorcycles to cars.

May I close by saying that this little fellow is still one of the best basic trainers in every way, has been with us a long while, served us well in war and peace, and will still be with us for many years to come. May this indeed be so.

Sutton, Surrey. ADRIAN A. DEVERELL.

Commercial Aircraft Data

YOUR contributor who compiled these data (THE AEROPLANE AND ASTRONAUTICS, October 16) is to be congratulated: the performance figures do seem to be comparable, which is far more than can be said for the correspond.ng manufacturers' figures published in the standard annual volume.

Vague questionnaires bring forth different standards of answers, so, because the publicist cannot be sure that his competitors will play fair, he may be tempted to quote better figures than those given in your supplement—then the whole volume becomes suspect and hence of considerably reduced value.

These annual data supplements of yours are most valuable, may I suggest that if you sent round advance notice, and asked for additional orders for the supplement alone prior to printing at, say, 1s. a time, you could sell 50% more that week.

Lytham St. Annes, Lancs. J. F. FOSS, A.F.R.Ae.S.

Their Like Has Gone

MY copy of THE AEROPLANE AND ASTRONAUTICS was somewhat delayed recently but I note with interest your reference to the late J. Mollison and very briefly to "Bert" Hinkler in your editorial of November 6.

It is indeed true that men's great deeds, like their good deeds, are often interred with their bones. I always consider that these two men did more to further the interest of the light aeroplane than any others before or since. Both were brilliant navigators, possessing a type of courage rapidly becoming obsolete in a world of radar and modern navigational aids.

However it is unlikely that even time will produce an aircraft engine of greater efficiency than the Gipsy Major at least from the reliability viewpoint. Jim's passing reminds us of so much that has gone, we shall never see their like again in aviation.

Watford, Herts. E. W. BAKER.

Smooth and Polished Commentaries

AFTER considering some of the implications in Mr. D. W. Lancaster's letter, concerning the possibility of manufacturers' representatives giving the commentary at the S.B.A.C. Show (Sept. 25 last), I feel that possibly he has never been subjected to the irritating and disjointed commentary he has suggested. This type of commentary has often been given in the U.S.A., the last example I heard being the World Congress of Flight at Las Vegas. It resulted in frantic efforts by all concerned to out-do the competition, resulting in a spate of half-truths and irrelevant comments, usually quite disconnected with the displaying aircraft's manœuvres. Some speakers are calm and collected, some frenzied and confused, resulting in a disconcerting and irritating background, detracting rather than adding to the pilot's efforts to show off the firm's products.

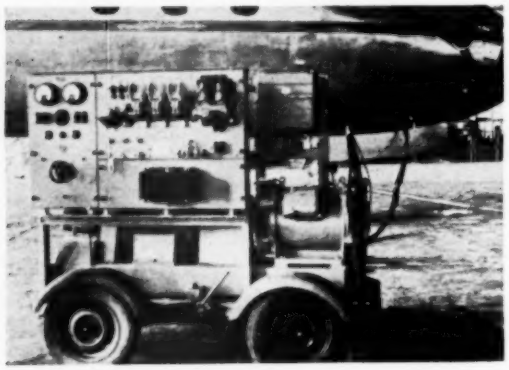
From the practical point of view, at the S.B.A.C. Show the timing for each item varies for a number of reasons. For example, this year the Comet 4B made only one fly-by and then landed. Imagine the plight of the D.H. commentator trying to "sell" the aircraft compared to his opposite number at, say, Faireys dealing with the Gannet AEW.3! Also, the displays at Farnborough are interlocking all through the flying, in that one aircraft takes off before the previous one has landed and this would require much handing backwards and forwards of the mike.

No, let's keep Oliver Stewart on the job he does so well and we'll then continue to enjoy smooth and polished commentaries matching the pilot's flying.

Torrance, Calif. ROBERT D. ARCHER, A.R.Ae.S.

Antipodean Wroundabout will be found on page 549.

NOTES AND EVENTS



IN HONG KONG.—One of the mains-driven generating sets supplied by Associated Electrical Industries, Ltd., to the Hong Kong Aircraft Engineering Co., Ltd. These sets are used for servicing the Britannia and Electra. They consist of a 2-pole squirrel-cage induction motor, coupled by flexible drive to a 3-phase 393 c/s, 2,950 r.p.m. alternator.

SCHOLARSHIP.—For the 22nd year Zonta International is offering its Amelia Earhart Scholarship. The grant of $2,500 is to enable women to take a course of graduate research in aeronautical engineering or space physics. Basic requirements are a bachelor's degree in science, plus evidence of exceptional ability and personal character. Further information may be obtained from Zonta H.Q., 59 East Van Buren Street, Chicago 5, Illinois.

B.P. FILMS.—Three B.P. films were shown concurrently in several London cinemas on November 18. The films, whilst showing various activities of the company, laid particular emphasis on an ever increasing use of aircraft in the search for oil. "Skyhook" dealt with B.P.'s use of a Sikorsky S-62 to transport drilling plant to an inaccessib'e site in the Papuan jungle. The plant, 2,000 tons in all, was moved in loads of 2 tons from a base camp to the drilling site.

RUST INHIBITOR. — The Amber Chemical Co., Ltd., 11A, Albemarle Street, W.1, has extended its range of Ambersil products. The addition is an electrospray composed of a silicone based anti-tracking fluid, containing a rust inhibitor, packed in an Aerosol container.

HEPOLITE APPOINTMENT.—Mr. James E. Robinson, M.I.Mech.E., M.I.Mar.E., the chief engineer of Hepworth and Grandage, Ltd., Bradford. has been appointed to the company's board of directors. He will also continue in his capacity as chief engineer.

E.F.F.I.—Reference is made in the first issue of the "Bulletin of the Electronic Forum for Industry," to the problems associated with data reduction and processing in the aircraft industry. Mr. T. I. Quinn Hall, S.B.A.C., writing of the various facets of this subject, comments upon the specialized requirements of the industry. It is noted that the S.B.A.C. have embarked on an extensive programme of requirement analysis. It is hoped that the E.F.F.I. will prove a useful channel by which to make the industry's needs known, and that a study of these requirements will lead to more efficient and cheaper data reduction systems.

AIR MINISTRY CONTRACT.—Orders worth more than £500,000 have been received from the Air Ministry by Ruston Hornsby, Ltd., Linco'n. They are for a number of 410-kW., skid-mounted alternator sets.

Aviation Calendar

November 27.—R.Ae.S. Man-powered Aircraft Group lecture, "Man as an Aero Engine," by Dr. D. R. Wilkie, at the Library, 4 Hamilton Place, **London,** W.1, at 19.00 hrs.

November 28.—R.Ae.S. Halton Branch A.G.M. and Dinner, at the Branch H.Q., R.A.F. **Halton,** at 15.00 hrs.

November 30.—R.Ae.S. Henlow Branch, Film Night, in the Assembly Hall, R.A.F. Technical College, **Henlow,** at 19.45 hrs.

December 1.—R.Ae.S. lecture, "Transonic Flow over Swept Wings," by E. W. E. Rogers and Dr. I. M. Hall, at the Library, 4 Hamilton Place, **London,** W.1, at 19.00 hrs.

December 1.—Institution of Production Engineers South Eastern Region lecture, "Problems of Re-entry into the Earth's Atmosphere," by Dr. Hilton, at the Hatfield Technical College, **Hatfield,** at 19.30 hrs.

December 1.—R.Ae.S. Glasgow Branch lecture, "Astronautical Navigation," by P. H. Tanner, at the Royal College of Science and Technology, **Glasgow,** at 19.15 hrs.

December 2.—R.Ae.S. Swindon Branch lecture, "Man-powered Aircraft," by B. S. Shenstone, at the College, Victoria Road, **Swindon,** at 19.30 hrs.

December 2.—R.Ae.S. Preston Branch lecture, "The Armstrong Whitworth Argosy," by E. D. Keen, at St. John Ambulance Hall, **Preston,** at 19.30 hrs.

December 3.—R.Ae.S. Gloucester and Cheltenham Branch main lecture, "Some Servo Mechanisms for Supersonic Aircraft," by S. G. Glaze, at St. Mary's Hall, **Cheltenham,** at 19.30 hrs.

December 4.—Helic. Assn. of G.B. lecture, "Aerodynamic Aspects of the Fairey Rotodyne," by K. McKenzie, at the Library, 4 Hamilton Place, **London,** W.1, at 18.00 hrs.

Company Notices

NEW COMPANIES

J. E. D. Williams and Co. (Aviation Consultants), Ltd. (638,085).—Private co. Reg. Sept. 25. Cap. £1,000 in £1 shs. Directors: John E. D. Williams and Mrs. Anne Williams, both of 33 Thurloe Square, S.W.7; and Richard J. Bolton, Georæ Street Chambers, Staines. Sec.: Anne Williams. Reg. office: George Street Chambers, Staines.

Skycraft Services (London), Ltd. (640,085).—Private co. Reg. Oct. 20. Cap.: £7,000 in £1 shs. Objects: To establish, maintain, work and carry on lines of aerial communication by means of æroplanes, seaplanes, helicopters, etc. Subscribers are: John F. Smith, 137 Athenlay Road, Peckham, S.E.15. Solicitor's articled clerk: Alan D. Sims, 31 Hillfoot Road, Collier Row, Romford, Solicitor's clerk. Sol'rs.: Constant and Constant, 24 St. Mary Axe, E.C.3. Reg. office: Baltic Exchange Chambers, 24 St. Mary Axe, E.C.3.

Biggin Hill Flying Club, Ltd. (640,480).—Reg. Oct. 27. Original number of members is 100, each liable to £1 in the event of winding up. The income and property of the company, whencesoever derived, shall be applied solely towards the promotion of its objects. The management is vested in a committee the first members of which are: John A. Moyse, 387 London Road, Mitcham; Reuben R. Penna, 24 St. Peters Road, Croydon; Allen W. G. Wilson; Ronald A. Smith; Reginald A. Arnell; George Stewart; Victor Collin. Solrs.: Baker, Freeman and Co., 379 London Road, Mitcham.

Personal Notices

BIRTHS

Bryce.—On November 11, at 22 Kimberley Road, North Walsham, to Celia, wife of Flt. Lt. C. Bryce, R.A.F.—a daughter.

Clark.—On October 30, to Maureen (*née* Gore), wife of Flt. Lt. F. D. G. Clark, R.A.F.—a son.

Damment.—On November 9, at the Royal Oak, Barrington, Ilminster, to Jill (*née* Broadbridge), wife of Flg. Off. J. F. D. Damment—a daughter (Jennifer Louise).

Doherty.—On November 15, at Windlesham Maternity Home, to Thelma, wife of Sqn. Ldr. F. W. Doherty—a daughter (Kate).

Goadby.—On November 9, at Digby Cottage, North Luffenham, to Eleanor (*née* Cooper), wife of Flt. Lt. L. A. Goadby—a daughter (Julia Eleanor).

Hallam.—On November 9, to Olivia (*née* Raffles), wife of Bill Hallam of R.A.F. Leuchars—a son.

Lewis Lloyd.—On November 11, to Gunilla, wife of Flt. Lt. J. Lewis Lloyd, of R.A.F. Farnborough—a son (John).

Measures.—On November 6, at Stroud Maternity Hospital, to Margaret, wife of Wg. Cdr. W. E. G. Measures—a son (Robert Guy).

Murray.—On November 10, at R.A.F. Hospital, Nocton Hall, to Maureen (*née* Stewart), wife of Flt. Lt. M. R. Murray, a son (Thomas Scott).

Shaw.—On November 12, at U.S.A.F. Hospital, South Ruislip, to Anna (*née* Pootz), wife of Flt. Lt. D. M. Shaw, U.S.A.F.—a daughter (Sarah Elizabeth).

Starkey.—On November 5, at Calshot, to Joan, wife of Flt. Lt. D. A. J. Starkey, R.A.F.—a son (Timothy John).

Tunnicliffe.—On November 1, at R.A.F. Hospital, Wegberg, H.Q., R.A.F. Germany, to Edna, wife of Sqn. Ldr. A. Tunnicliffe—a son (Philip Alan).

Publications Received

SENT FLYING. The autobiography of Bill Pegg, with a foreword by Peter Masefield. 236 pp.; 8½ in. x 5½ in. Illustrated. Macdonald and Co., Ltd. Price 21s.

TARANTO. An account of the Taranto action carried out by the Fleet Air Arm against the Italian fleet. By Don Newton and A. Cecil Hampshire. 208 pp.; 5½ in. x 8¼ in. Illustrated. William Kimber and Co., Ltd. Price 25s.

AERO MODELLER ANNUAL, 1959-60. A review of the year's aero modelling. Compiled and edited by C. S. Rushbrooke and D. J. Laidlaw-Dickson. 160 pp.; 5½ in. x 8½ in. Illustrated. Model Aeronautical Press, Ltd. Price 10s. 6d.

VIBRATION ENGINFERING. By W. Ker Wilson. 292 pp.; 7½ in. by 10 in. Illustrated. Charles Griffin and Co., Ltd. Price 90s.

THE TALE OF THE COMET. By Derek D. Dempster. 218 pp.; 5½ in. by 8¾ in. Illustrated. Allen Wingate (Publishers), Ltd. Price 21s.

ADVANCES IN ASTRONAUTICAL ENGINEERING. The proceedings of three Annual Meetings and a Regional Meeting of the American Astronautical Society. Edited by Horace Jacobs. Four vols.; 9¼ in. x 6½ in. Chapman and Hall, Ltd. Price 80s. each vol.

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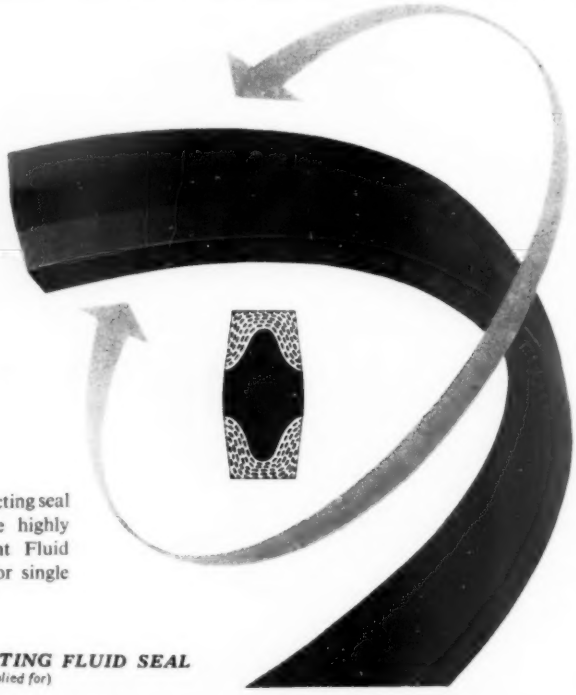

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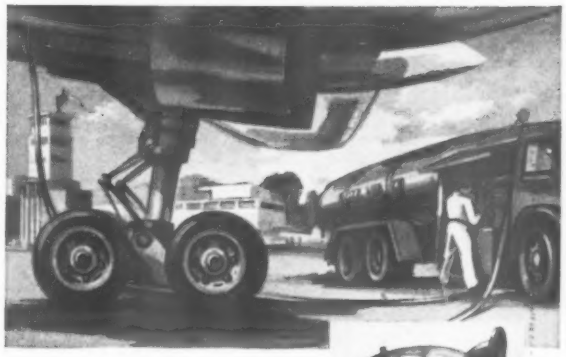

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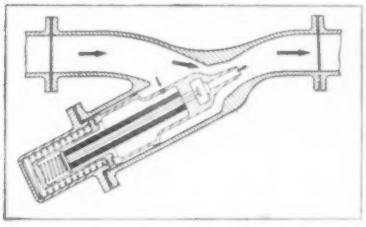

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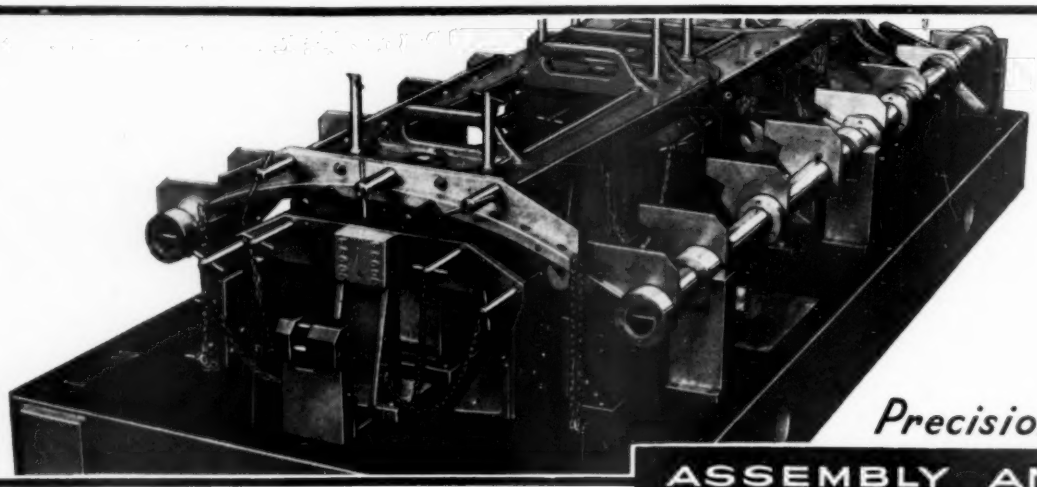

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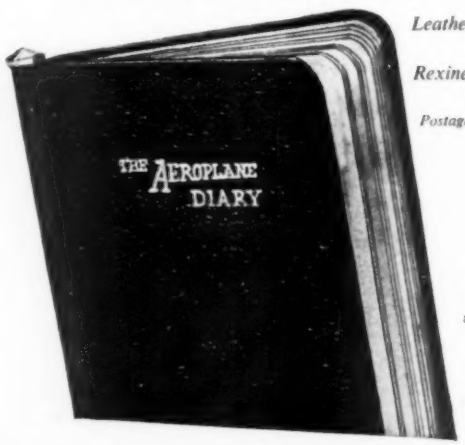

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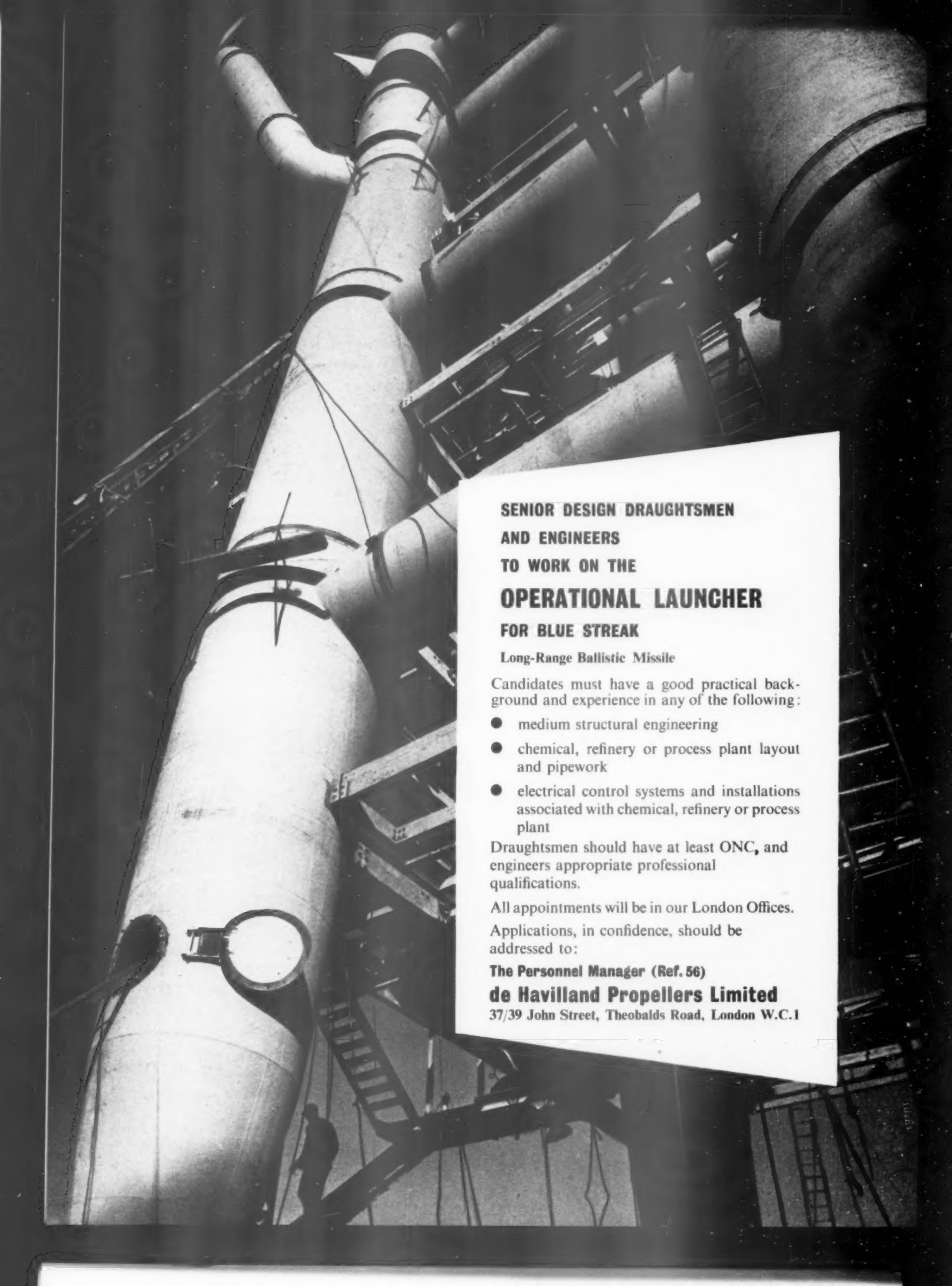

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These applications will be considered by the Council under the Terms of Reference issued to them by the Ministry of Civil Aviation on July 30, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. 510-1

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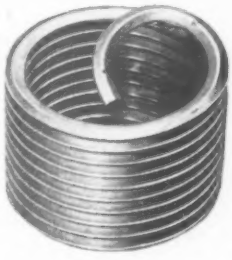

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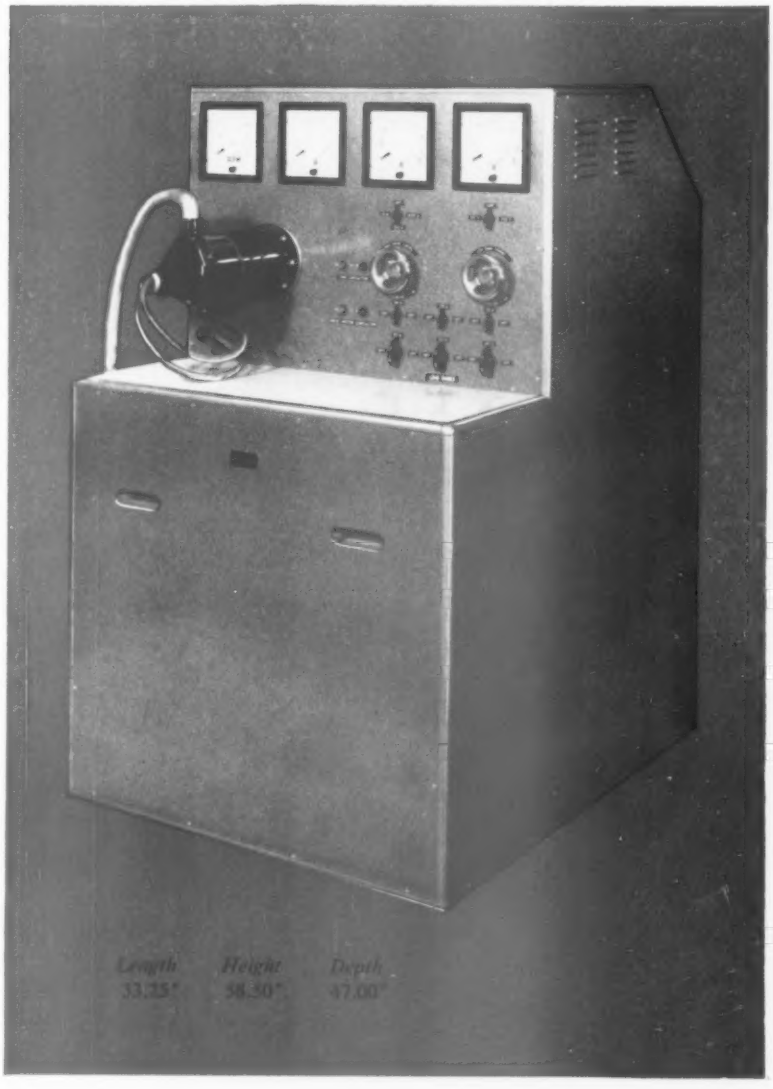

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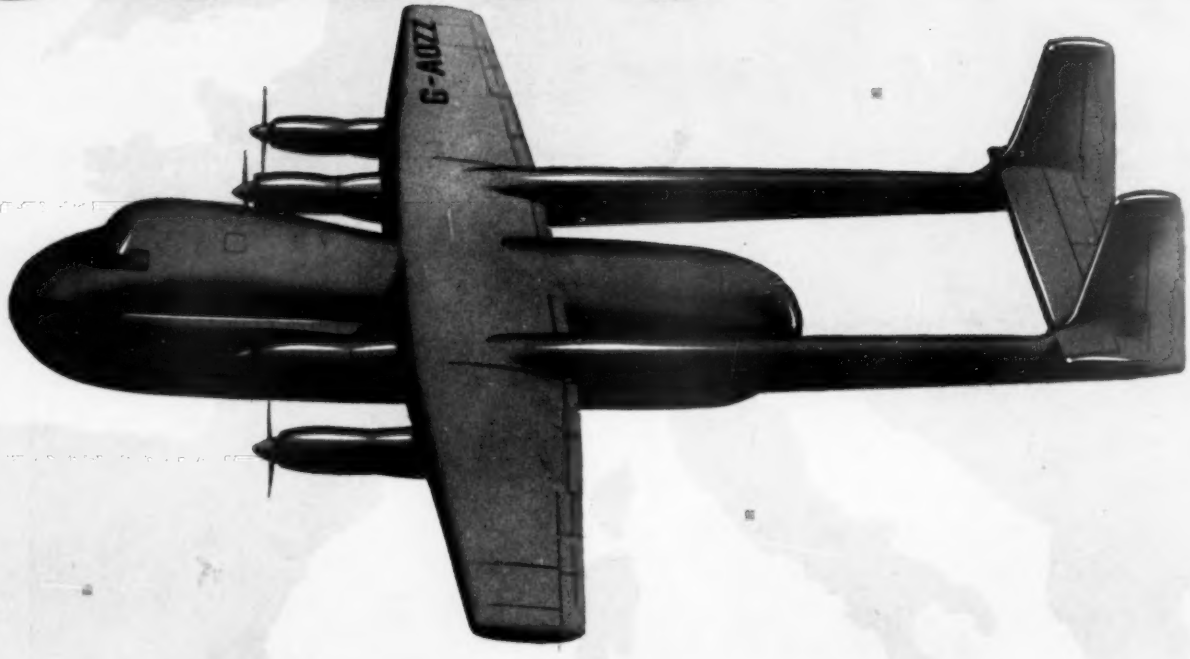

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